

This course is intended for previous Users of Process Simulator who have completed Basic Training but may not have used the software for a while.

Our hope is that this training will help these Users “brush up” on their skills so they can again use the software to benefit their business.

Process Simulator Basic Refresher Training Webinar



Process
simulator

Professional

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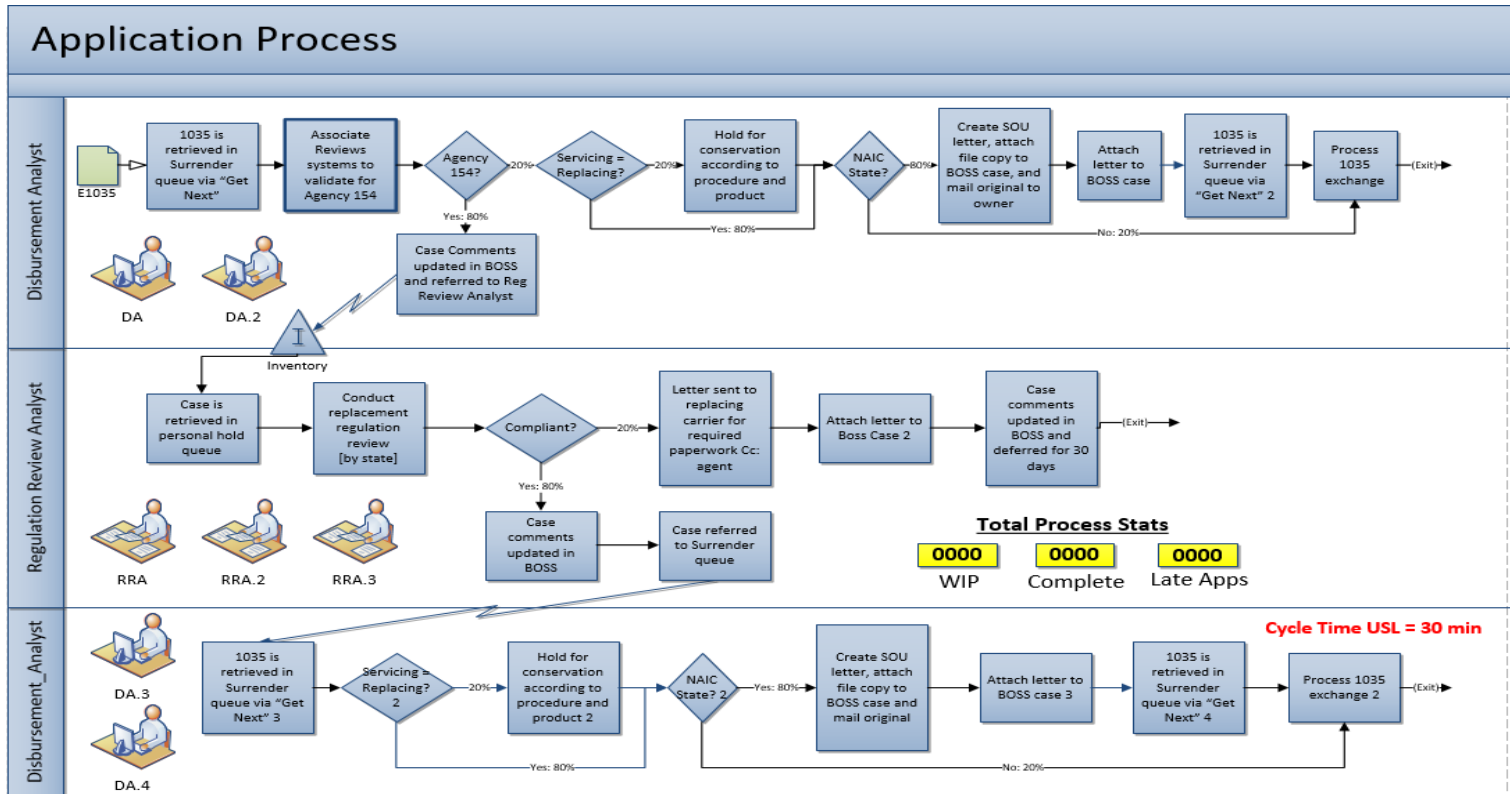
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For Software Version: 10.9
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Course Objectives

1. Review the basic features of Process Simulator
2. Provide demonstrations of how to use PCS
3. Show model examples
4. Answer Attendees' questions (*as time allows*)

Poll #1

Business Process Model Example



Agenda

Sections

1. How to use Process Simulator in Visio
2. Activities, Entities, & Arrivals
3. Routings
4. Resources & how to use them
5. User-Defined Expressions
6. Output Viewer
7. Scenarios

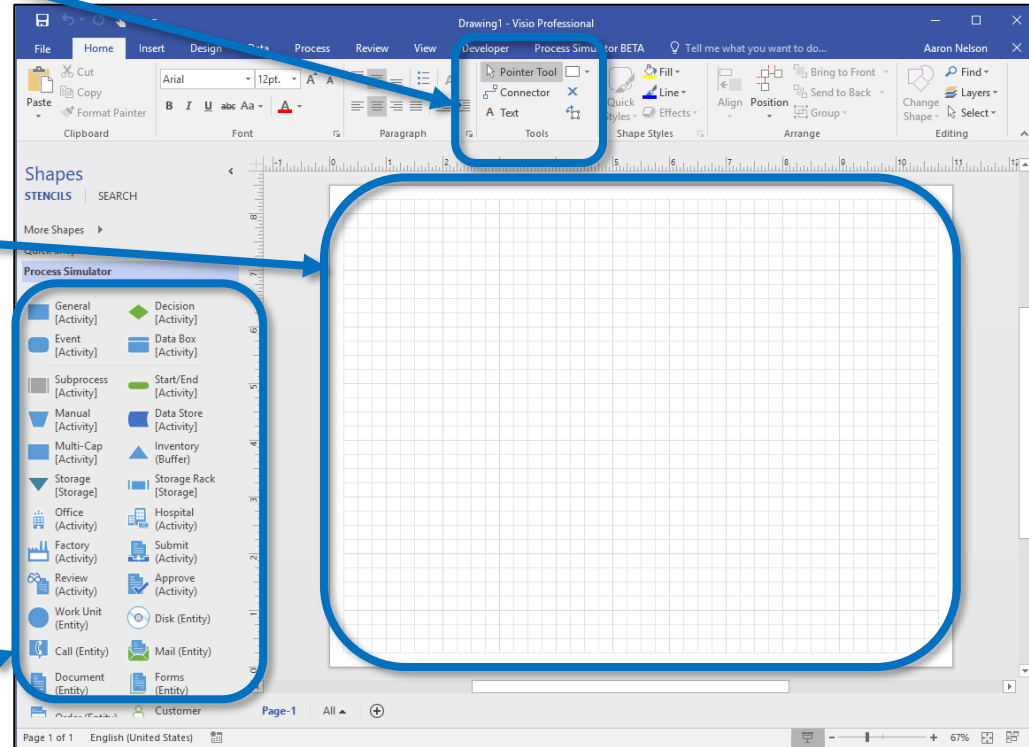
1. How to Use Process Simulator in Visio



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The Visio User Interface

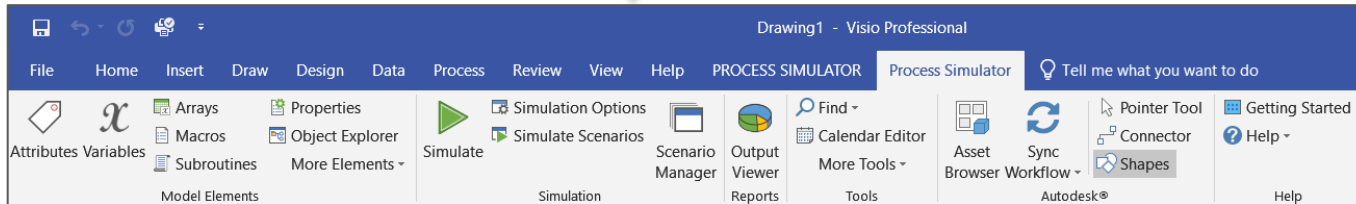
- The Home ribbon allows you to select Tools to point, add connectors, text, or custom shapes.
- The drawing page (or layout area) is where you draw your diagram using the shapes and tools available. You can add additional pages as needed.
- Stencils contain shapes



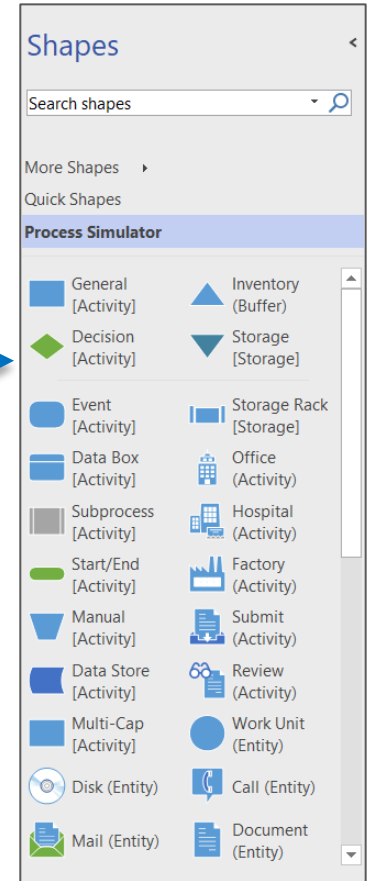
Process Simulator

- The Process Simulator Stencil and Ribbon Bar

Ribbon Bar



Shape Stencil



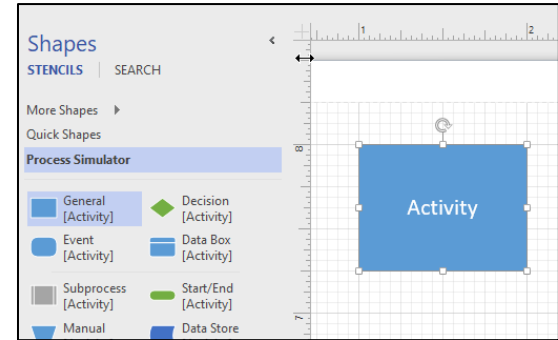
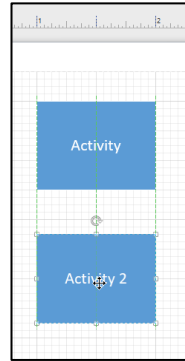
Typical Shapes

- Process Step or Activity
- Decision Diamond
- Process Flow (Routing arrows)
- You may also choose to use graphics to represent process steps or any element of your process map.



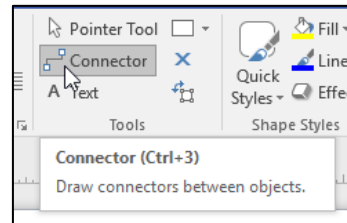
Basic Flowcharting in Visio

1. Select the Shape from the Process Simulator Stencil. While holding down the left mouse button, drag the shape to the layout and release the button, adding the shape.

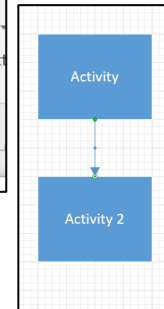


2. Repeat this process to add an additional shape (or you may copy & paste the first shape).

3. Select the Connector Tool (from the Home Ribbon) to add connections between shapes.

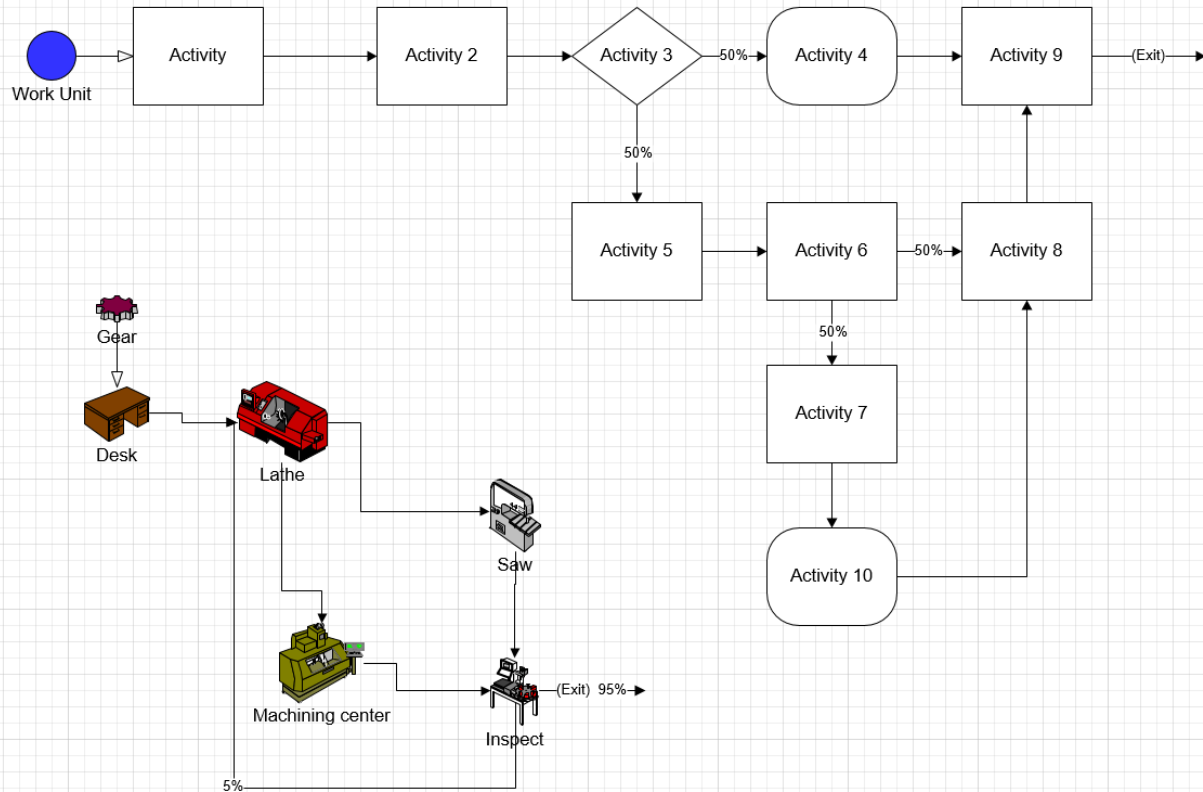


4. Drag and drop the connection between shapes.



Visio also has an Auto Connect feature that your instructor can demonstrate

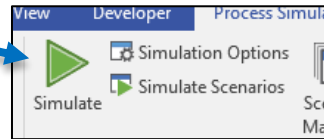
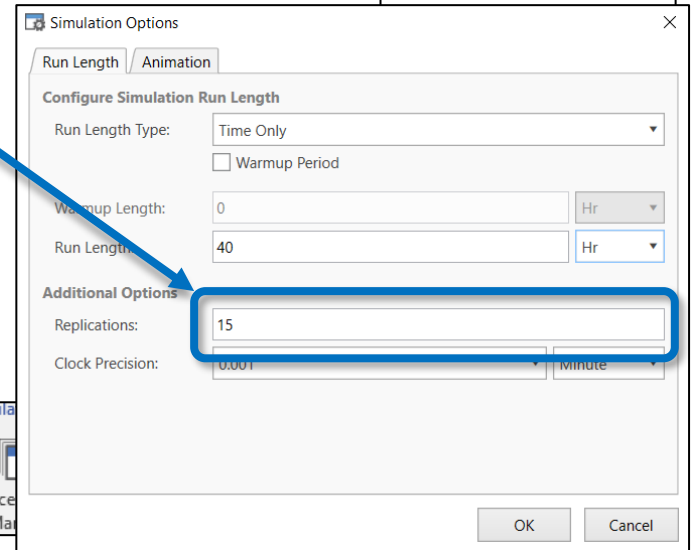
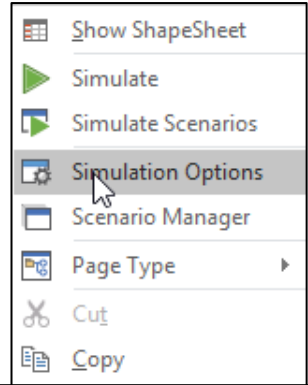
Demo 1: Build 1-2 Models Live



Poll #2

Run the Simulation

- Check your Simulation Properties by right-clicking on the Layout and selecting Simulation Properties.
- Enter 15 for the number of replications. Then click OK.
- Click on the Simulate button to start the simulation



Runtime Control

Play/Pause/Stop (points to Play, Pause, Stop buttons)

Zoom to Fit Layout (points to Zoom to Fit button)

Animation Speed (slider bar) (points to the slider bar)

Animation On/Off (points to Animation button)

Simulation Time (points to Run 1 of 15 and HR:00 MIN:38)

Resource Colors:
Normal = Idle
Green = Busy
Red = Unavailable

In Buffer Contents (points to activity A4)

Out Buffer Contents (points to activity A5)

Current Contents (if capacity > 1) (points to activity A5)

Stochastic Example with Uncertainty and Interdependency (points to the simulation flow)

W(4) minute Process Time
80% Resource Availability
Assembly Opn
(Attach Route - After Activity)

4 Total Exits
12.32 Avg CT (min)

Simulation - Visio Professional

Simulation toolbar: Variables, Arrays, One Activity, Zoom to Fit, Views List, Play, Pause, Stop, Animation, User Pause by Time, User Pause by Date, Step Events, Continuous, Trace Filter, Trace to File, Debug Logic.

Info, View, Simulate

Run 1 of 15 | HR:00 MIN:38

Activity A4: 2 In Buffer, 4 Out Buffer

Activity A5: 0 In Buffer, 2 Out Buffer

Resources: Worker 4, Worker 5 (green); Work Unit 4, Work Unit 5 (blue)

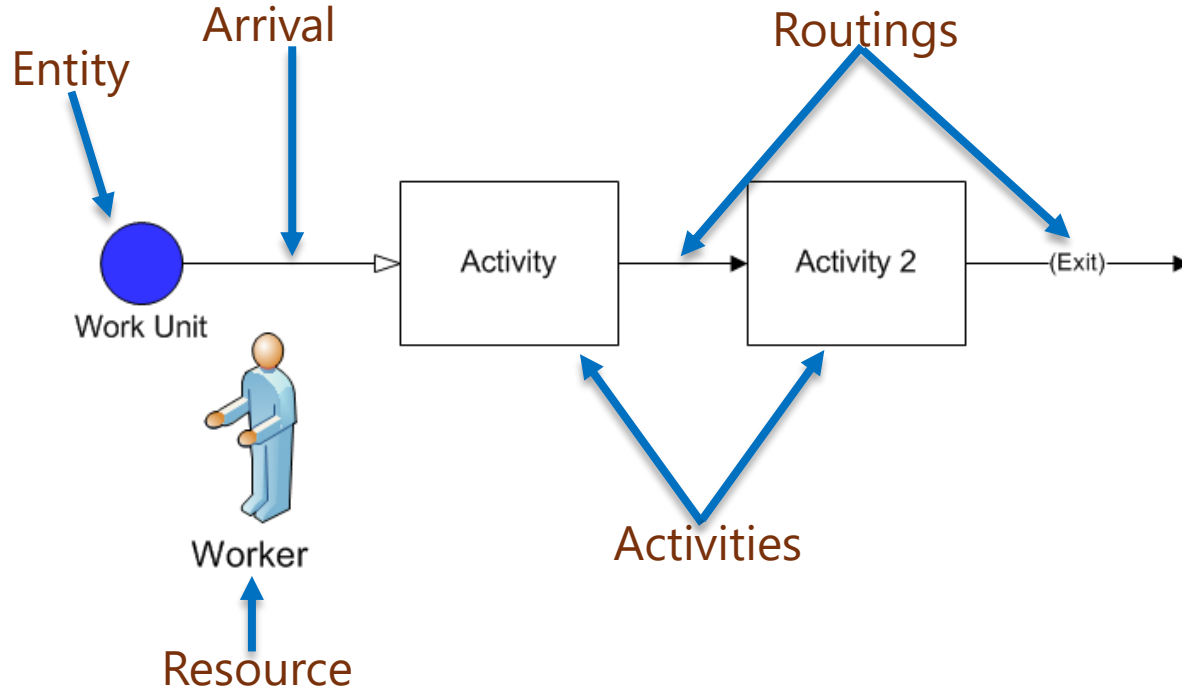
2. Activities, Entities, & Arrivals



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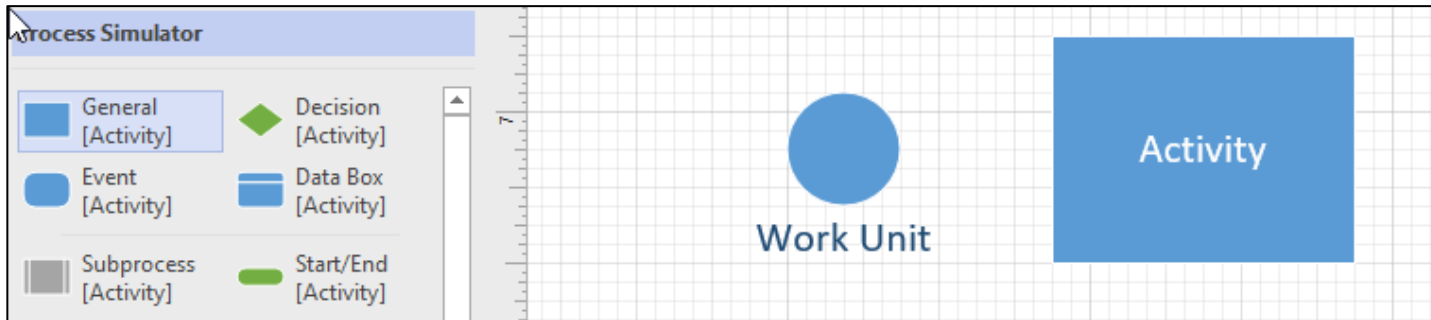
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5 Basic Modeling Elements



Create Activity

- Click and drag your Activity box from the Process Simulator stencil to your workspace.



Activity Properties & Logic

Properties

ACTIVITY | LOGIC

Name: Activity

Capacity: 1

Buffers: In: 999 Out: 0

Time: T(3, 5, 10) Min

Multi Entity: Define

Hourly Cost: 0

- ▶ Resource
- ▶ Availability
- ▶ Batching
- ▶ Setup
- ▶ Downtimes
- ▶ Notes
- ▶ Advanced

Properties

ACTIVITY | **LOGIC**

1

Once the Properties are open you do not need to close them or reopen as you move on to other shapes.

Multi Entity

- When we have Entities with different names, all routing through the same process record, we can define different process times for each Entity, based on Entity name.
- This is done on the Multi Entity tab:

Properties

ACTIVITY | LOGIC

Name: Activity

Capacity: 1

Buffers: In: 999 Out: 0

Time: T(3, 5, 10) Min

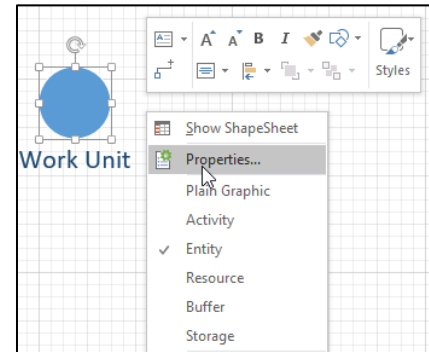
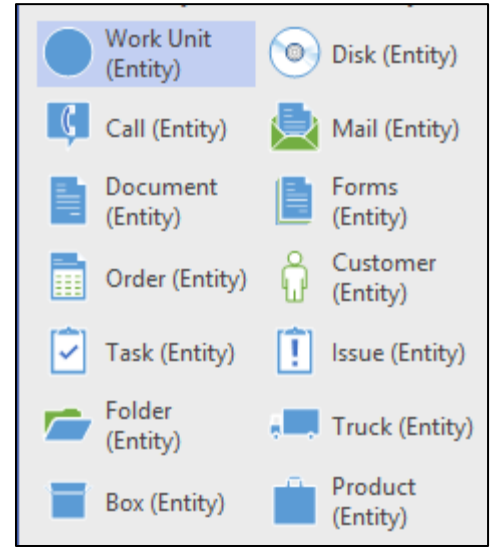
Multi Entity: Define

Hourly Cost: 0

	Entity	Time	Resource	Priority	Keep
1	LH	U(1, 0.2) Min		0	<input type="checkbox"/>
2	RH	U(1.2, 0.2) Min		0	<input type="checkbox"/>

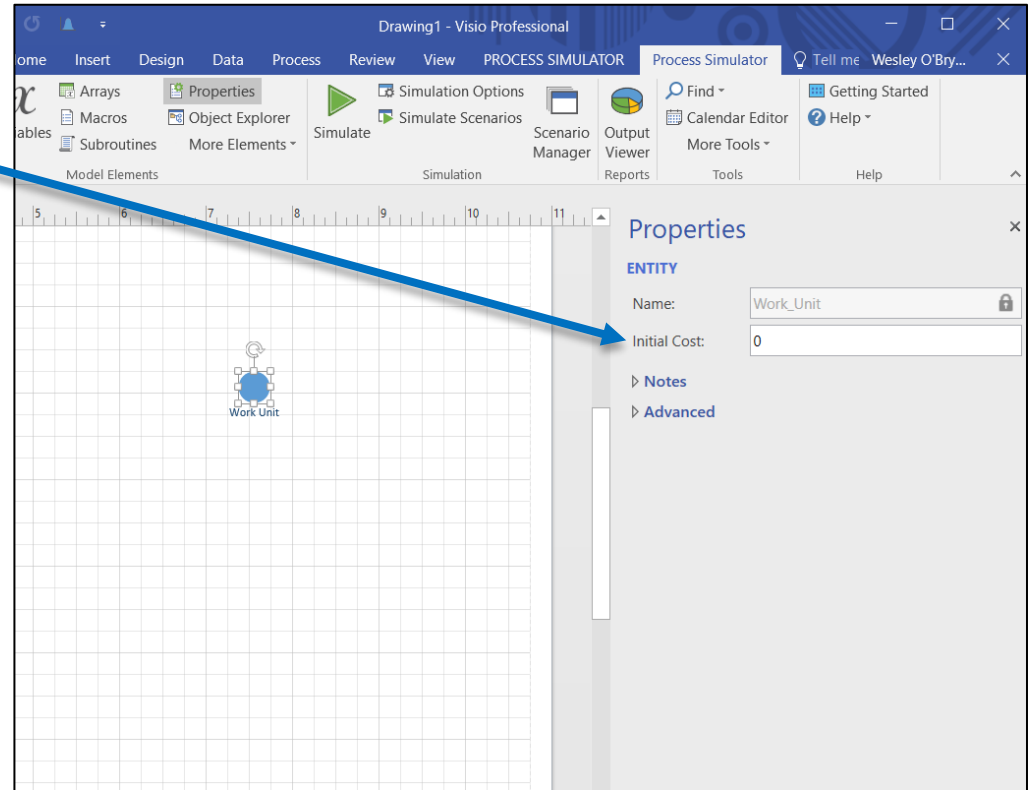
Create Entity

- Left-click and drag your Work Unit Entity from the Process Simulator stencil to your layout.
- After placing the entity on your layout, you can right-click on the entity to bring up the Properties dialog.



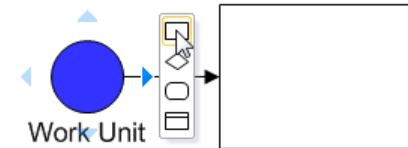
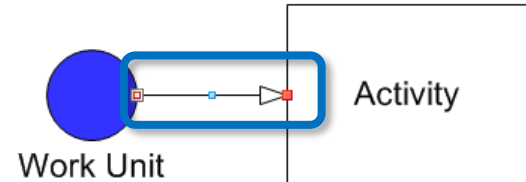
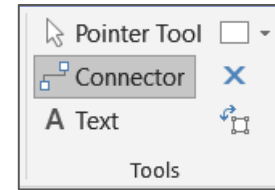
Entity Parameters

- The only data associated with an entity is an initial cost. You may also specify whether or not to collect statistics for each entity type.
- In order to use an entity in the model, you must place an entity shape on the screen. The shape does not need to be attached to anything, although it may be attached to an activity to represent an arrival.



Entity Arrivals

- To Create an Arrival:
- From the Home Ribbon, select the Connector Tool and click between connection points from the Entity to the Activity.
- Or use the AutoConnect feature to create the Arrival connection arrow between the Entity and the Activity where it first arrives in the system.
- Hover over the Entity shape and then click on the blue arrow that appears closest to the Activity.
- Alternately, use AutoConnect to create a new Activity block (if it does not exist already) where the Entity first arrives.



Arrival Types

- **Periodic** Arrivals specify the frequency of arrival, the quantity per arrival, and the time of the first Arrival. The Occurrences field allows you to define a finite number of arrivals.
- **Continuous** arrivals will create Entities as long as there is capacity at the input activity (or queue).

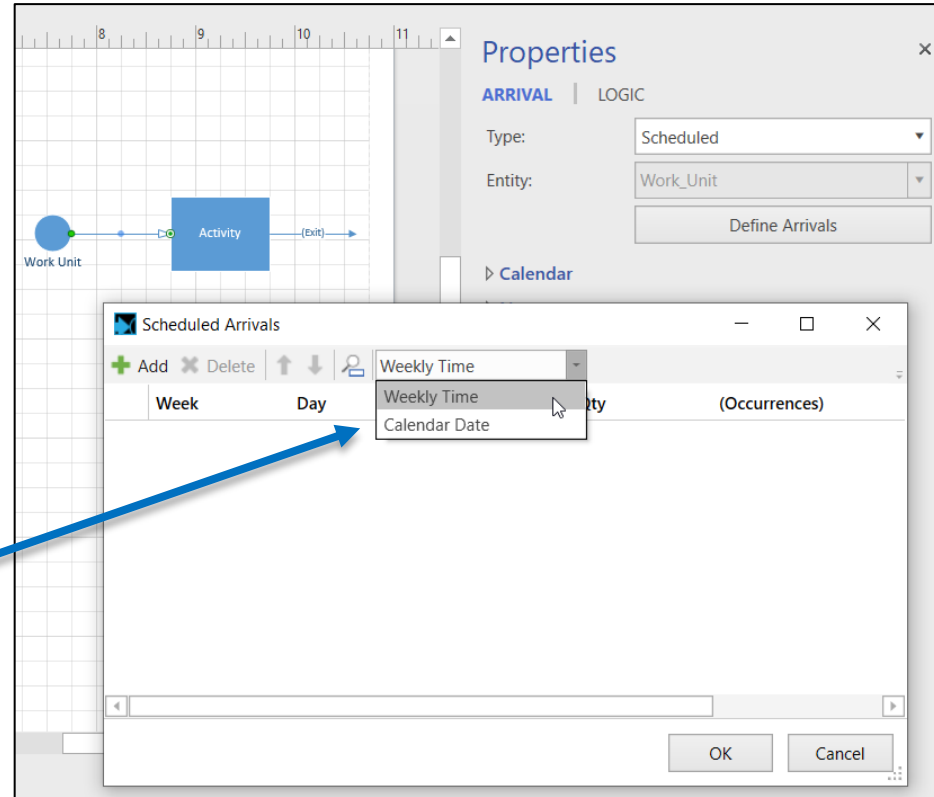
The screenshot shows a software interface with a grid on the left and a 'Properties' panel on the right. In the grid, a blue box labeled 'Activity' has an arrival icon (a triangle with a dot) on its left side. The 'Properties' panel has tabs for 'ARRIVAL' and 'LOGIC'. Under the 'ARRIVAL' tab, the following settings are visible: 'Type' is set to 'Periodic', 'Entity' is 'Work_Unit', 'Occurrences' is 'Infinite', 'Interval' is '5' with a 'Min' dropdown, 'Quantity' is '1', and 'Start Time' is '5' with a 'Min' dropdown. Below these are expandable sections for 'Calendar', 'Notes', and 'Advanced'.

The screenshot shows the same software interface as above, but with the 'Type' dropdown in the 'Properties' panel set to 'Continuous'. All other settings, including 'Entity' (Work_Unit), 'Occurrences' (Infinite), 'Interval' (5), 'Quantity' (1), and 'Start Time' (5), remain the same.

Scheduled Arrivals

Multiple Scheduled Arrivals may be used for an Entity entering a Single Activity!

- **Scheduled** Arrivals allow you to specify the week, day, and time of the Arrival.
- **Scheduled** Arrivals may also be defined by calendar date and time



Only 1 Pattern Arrival can be used for an Entity entering a Single Activity!

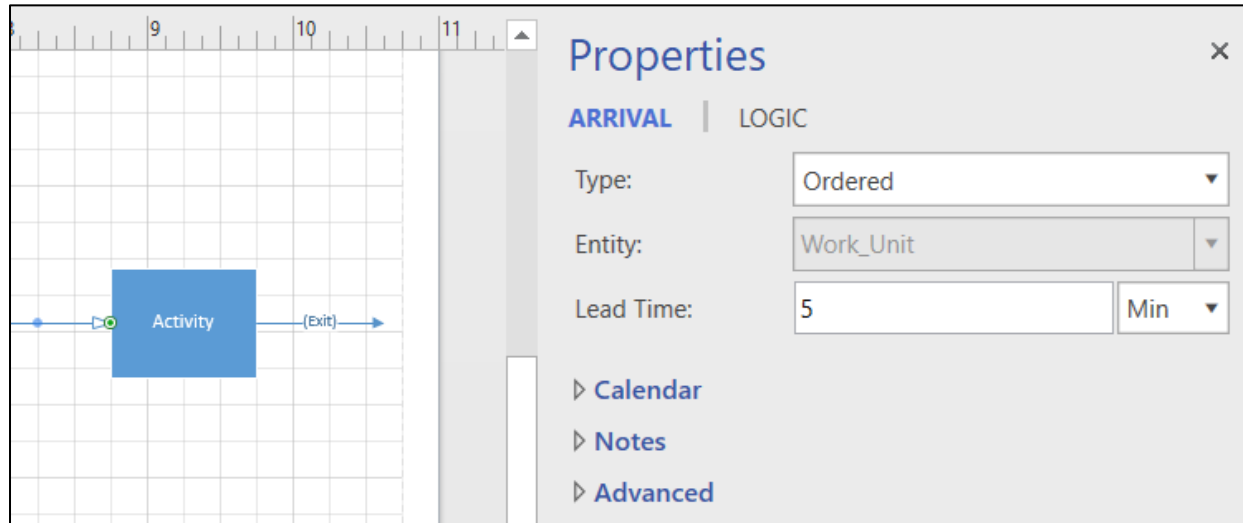
Pattern Arrivals

- **Pattern** Arrivals are similar to Scheduled arrivals but Arrival quantity is randomly spread out over the time period given on each line.
- Variability of quantity can be toggled on or off via button.

	Week	Day	Start	End	P(Qty)
1	1	Monday	8:00 AM	5:00 PM	150
2	1	Tuesday	8:00 AM	5:00 PM	100
3	1	Wednesday	8:00 AM	5:00 PM	120
4	1	Thursday	8:00 AM	5:00 PM	100
5	1	Friday	8:00 AM	5:00 PM	200

Ordered Arrivals

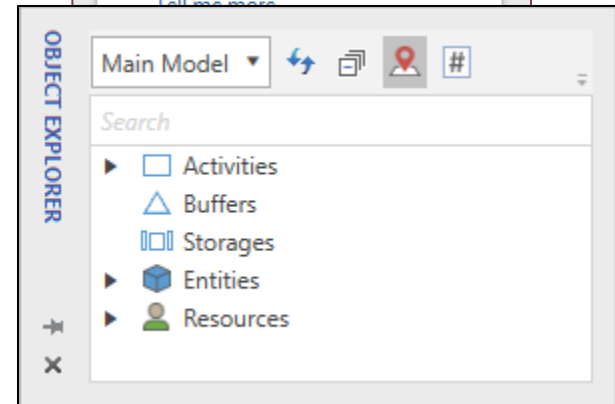
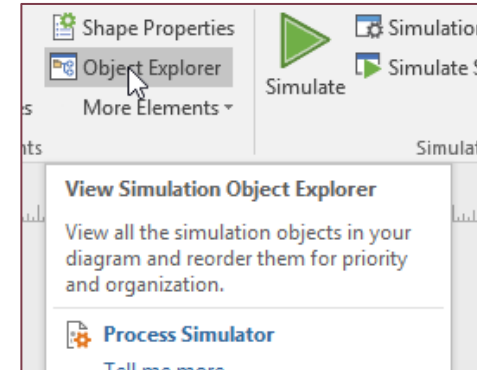
- **Ordered** Arrivals only occur when an associated input queue drops to a specified level. You may specify the Lead Time necessary to fulfill the Arrival.



The screenshot displays the ProModel software interface. On the left, a grid-based workspace shows a blue rectangular activity labeled "Activity". An arrow points into the activity from the left, and another arrow labeled "(Exit)" points out to the right. A vertical ruler at the top of the grid shows time markers at 9, 10, and 11. On the right side, a "Properties" window is open, showing the configuration for the selected activity. The window has a close button (X) in the top right corner. It features two tabs: "ARRIVAL" (selected) and "LOGIC". Under the "ARRIVAL" tab, the following settings are visible: "Type:" is set to "Ordered" (dropdown menu); "Entity:" is set to "Work_Unit" (dropdown menu); "Lead Time:" is set to "5" (text input) with a "Min" dropdown menu. Below these settings are three expandable sections: "Calendar", "Notes", and "Advanced", each with a right-pointing triangle icon.

Object Explorer

- Select Object Explorer from the Model Elements Section of the Process Simulator 2019 ribbon.
- Allows you to quickly and easily view and change parameters for all simulation objects



Demo 2: Cafeteria Model with Multiple Arrival Types

OBJECT EXPLORER

Main Model

Search

- Activities
- Buffers
- Storages
- Entities
 - Dessert
 - Beverage
 - Bottle_Bev
 - Breakfast
 - Café_Fresco
 - Deli
 - Entree
 - Grill
 - Impulse
 - Pizza
 - Salad
 - Soup
 - Customer**
 - Customer at Customer_Entry (Pattern)
 - Customer at Customer_Entry (Scheduled)
 - Customer at Customer_Entry (Scheduled)
 - Customer at Customer_Entry (Scheduled)

Hospital Cafeteria Model

Salad S, Soup, Salads, Grill, Favorite, Work, Customer, Pizza S, Pizza, Entrée S, Impulse, Desserts, Beverages, Cashiers

Properties

ARRIVAL | LOGIC

Type: Pattern

Arrivals 68

Pattern Arrivals

Week	Day	Start	End	Qty
1	Thursday	12:45 AM	1:00 AM	23
2	Thursday	1:00 AM	1:15 AM	19
3	Thursday	1:15 AM	1:30 AM	21
4	Thursday	1:30 AM	1:45 AM	12
5	Thursday	1:45 AM	2:00 AM	19
6	Thursday	2:00 AM	2:15 AM	14
7	Thursday	2:15 AM	2:30 AM	19
8	Thursday	2:30 AM	2:45 AM	15

Customer Transactions

Item	Qty
Dessert	0000
Beverage	0000
Bottle Bev	0000
Breakfast	0000
Café Fresco	0000
Deli	0000
Entree	0000
Grill	0000
Impulse	0000
Pizza	0000
Salad	0000
Soup	0000
Theme Cuisine	0000
Total Food Items Sold	0000
Customer Transactions	0000

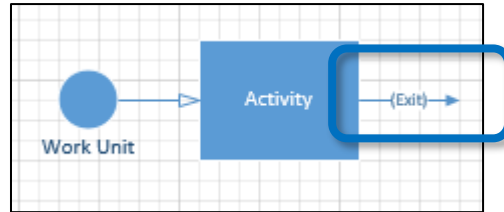
3. Routings



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Entity Routings

- Routings define the process flow from activity to activity, and to “Exit” (where the entity leaves the system).



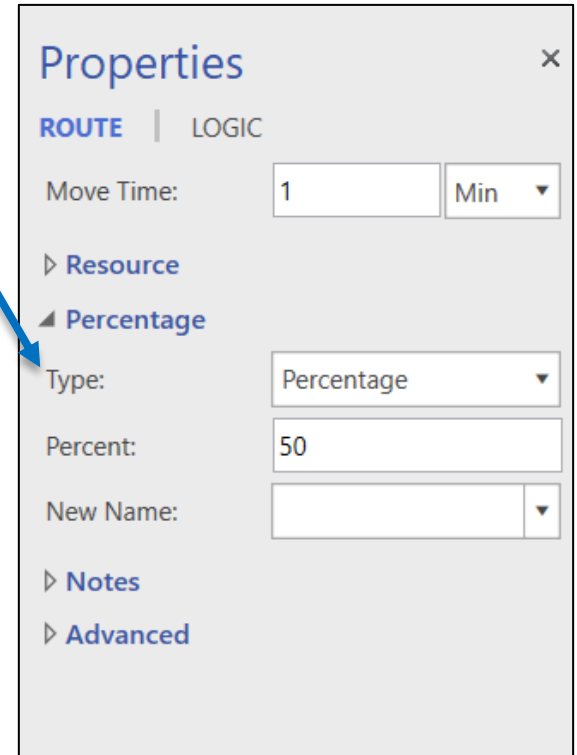
- Use the AutoConnect to create the routing from Activity to Exit (hover over the Activity and click and drag on a blue arrow that appears).

Routing Shape Properties & Types

- Routings specify how an entity gets from one activity to another. You can specify a simple time, or you can require the use of a resource. You can also specify complex logic to select multiple resources or any other condition that must be met before the routing occurs.
- Each Routing type has its own parameters.

Routing Types:

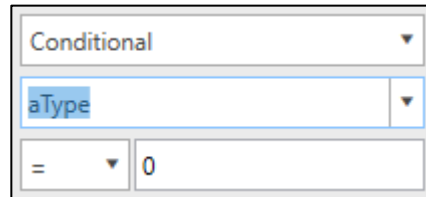
- Percentage
- Conditional
- Attach
- Detach
- Create
- Send
- Outlet
- Flexible



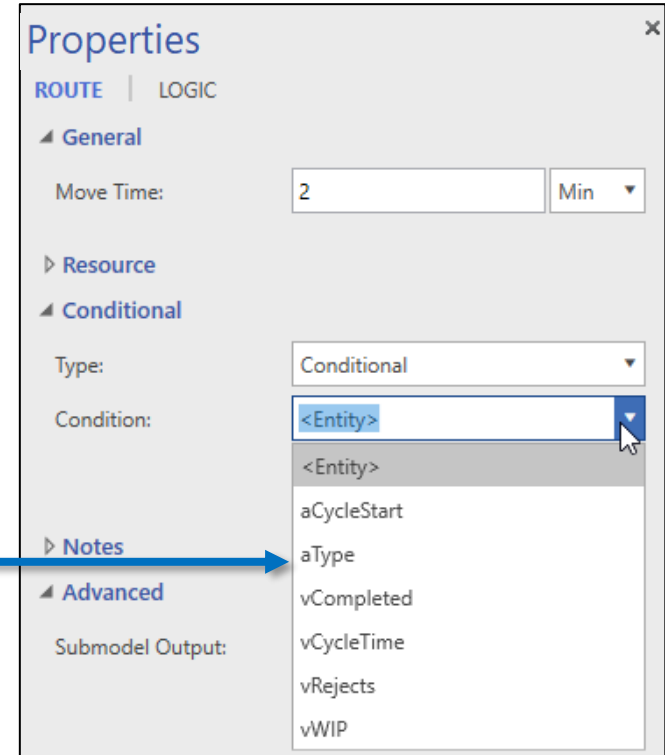
The screenshot shows a 'Properties' dialog box with a close button (X) in the top right corner. It has two tabs: 'ROUTE' (selected) and 'LOGIC'. Under the 'ROUTE' tab, there is a 'Move Time' field with a value of '1' and a unit dropdown set to 'Min'. Below this is a section for 'Resource' with a dropdown menu currently set to 'Percentage'. Underneath, there is a 'Type' dropdown set to 'Percentage', a 'Percent' field with the value '50', and a 'New Name' field with a dropdown arrow. At the bottom, there are two expandable sections: 'Notes' and 'Advanced'.

Conditional Routing

- The Conditional Route type allows for routing based on some condition being true:

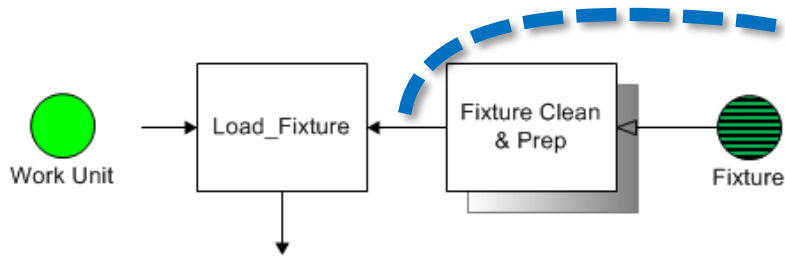


A screenshot of a route configuration dialog box. The 'Type' dropdown is set to 'Conditional'. The 'Condition' dropdown is set to 'aType'. Below the dropdowns, there is an equals sign followed by a dropdown set to '0'.



A screenshot of the 'Properties' window for a 'ROUTE' object. The 'LOGIC' tab is selected. Under the 'Conditional' section, the 'Type' is set to 'Conditional' and the 'Condition' is set to '<Entity>'. A dropdown menu is open, showing a list of available entities: '<Entity>', 'aCycleStart', 'aType', 'vCompleted', 'vCycleTime', 'vRejects', and 'vWIP'. A blue arrow points from the 'aType' dropdown in the dialog box to the 'aType' option in this list.

Attach (an Entity)



- The number of entities (Fixtures) to be attached to each entity waiting at the connecting activity (Work Unit @ Load Fixture)
- After the Load Fixture Activity time is complete, the base entity will attach the total number of entities defined in Quantity field and wait if all entities are not available to be attached.

Properties

ROUTE | LOGIC

Move Time: Min ▾

▸ Resource

▾ Attach

Type: ▾

Quantity:

Quantity Mode: ▾

Time Limit: Min ▾

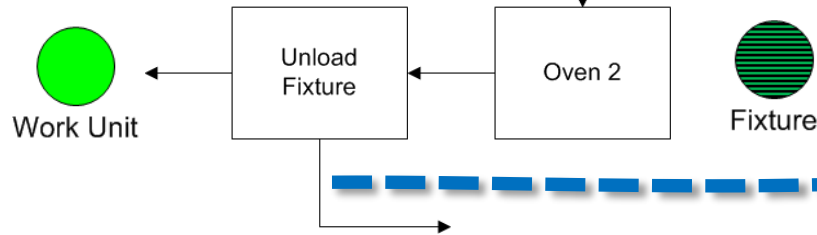
Attach To: ▾

When: ▾

Condition: ▾

Permanently:

Detach (an Entity)



- Select from the dropdown list
- Detach entities (Fixtures) after the activity (Unload Fixture)
- The condition by which an entity will be detached (i.e. Entity Name, attribute, or variable)
- The condition that must be satisfied for the entities to detach

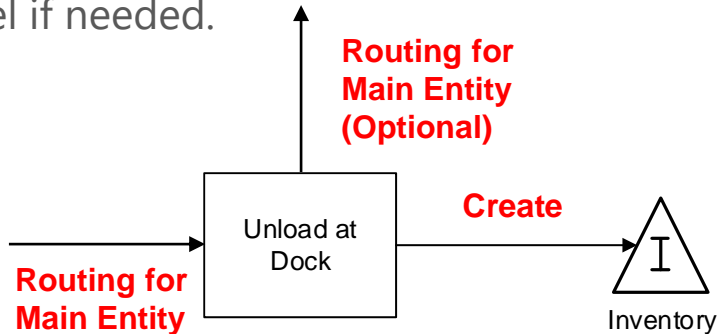
The screenshot shows the 'Properties' window for the 'Unload Fixture' activity. The 'ROUTE' tab is selected. The 'Move Time' is set to 7 minutes. The 'Resource' is set to 'Fixture'. The 'Detach' section is expanded, showing the following configuration:

- Type: Detach
- When: After Activity
- Condition: <Entity>
- Operator: =
- Entity Name: Fixture

Blue arrows point from the list items to the corresponding fields in the 'Properties' window. A blue box highlights the 'Type' dropdown menu.

Create Routing

- Creates one or more new Entities before or after the Creator Entity completes its time and logic.
- You must select the name of the Entity as well as the quantity to be created.
- Note that all new created Entities have the same Attribute values as the Creator Entity. This can be useful to reunite Entities later in a model if needed.



Properties

ROUTE | LOGIC

Move Time: Min ▼

▶ Resource

▲ Create

Type: ▼

When: ▼

Entity: ▼

Quantity:

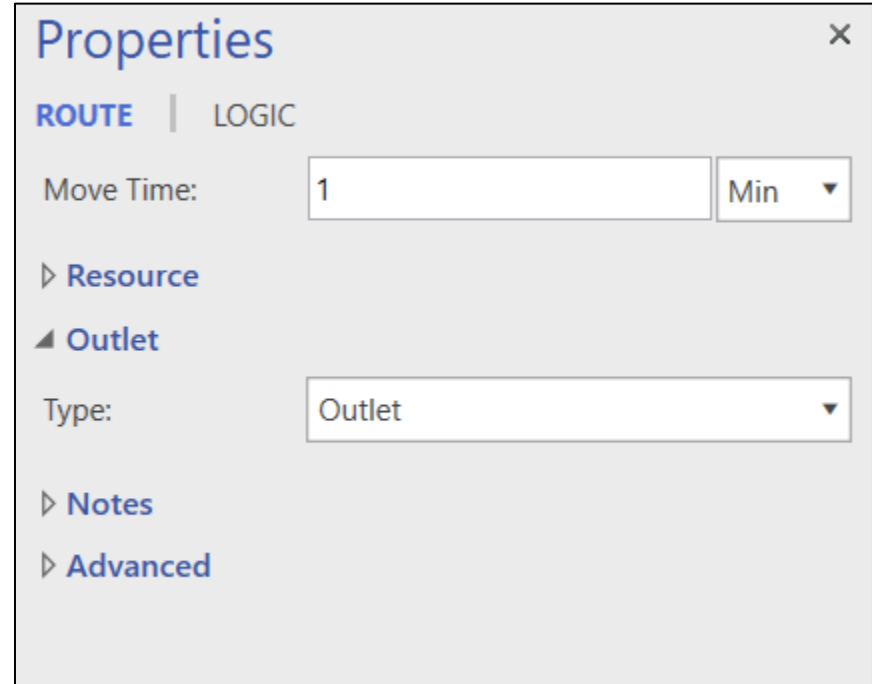
▶ Notes

▲ Advanced

Submodel Output:

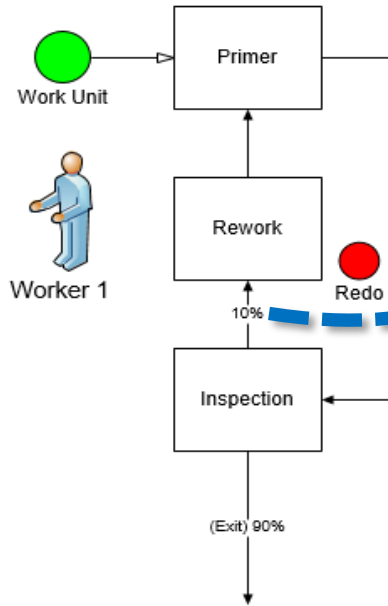
Outlet Routings

- When an Outlet Routing is defined, the entity will select this route if all other connections lead to activities that are unavailable, because they are off-shift or have no available capacity.



The screenshot shows a 'Properties' dialog box with a close button (X) in the top right corner. It has two tabs: 'ROUTE' (selected) and 'LOGIC'. Under the 'ROUTE' tab, there is a 'Move Time' field with the value '1' and a dropdown menu set to 'Min'. Below this are expandable sections: 'Resource' (expanded), 'Outlet' (collapsed), 'Notes' (expanded), and 'Advanced' (expanded). The 'Outlet' section is currently collapsed, but its 'Type' field is visible, showing 'Outlet' in a dropdown menu.

New Entity Name with Routing



Properties

ROUTE | LOGIC

Move Time: Min

▶ Resource

▲ Percentage

Type:

Percent:

New Name:

▶ Notes

▶ Advanced

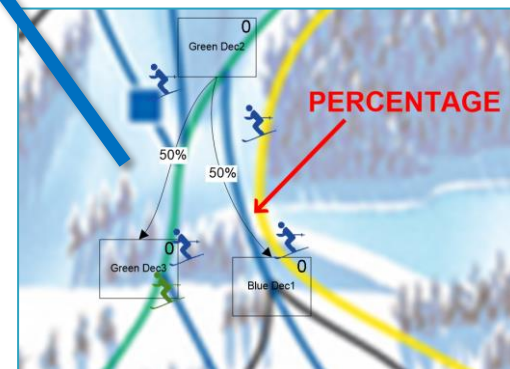
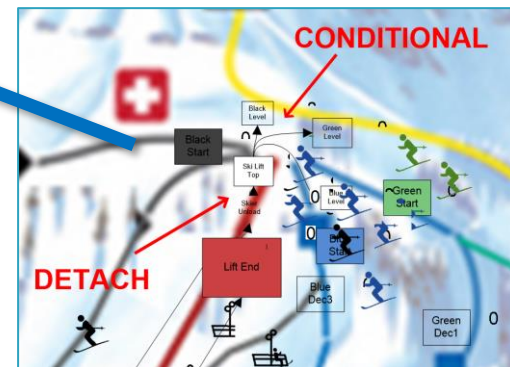
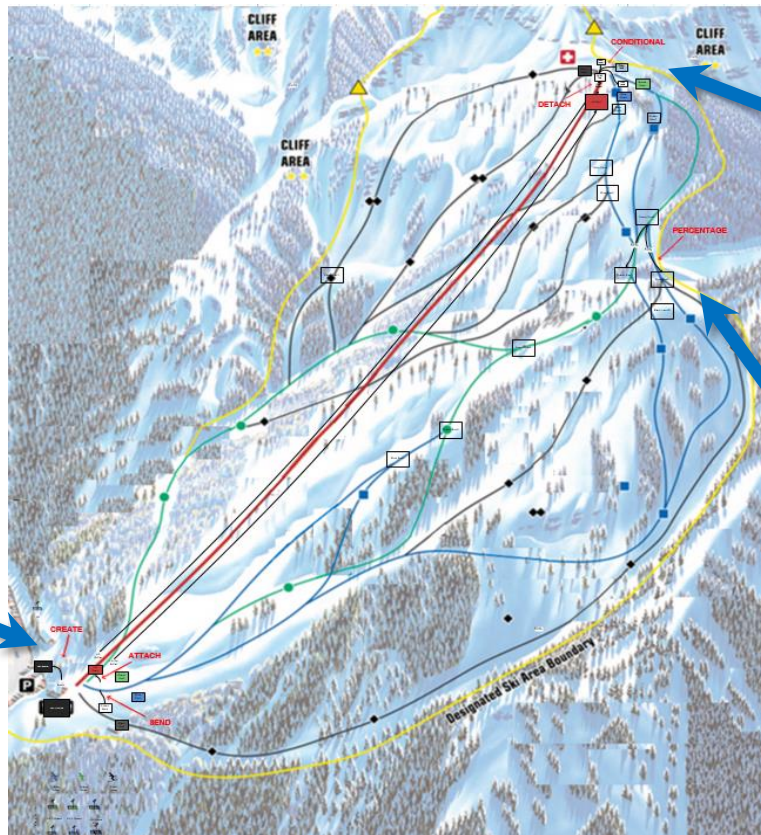
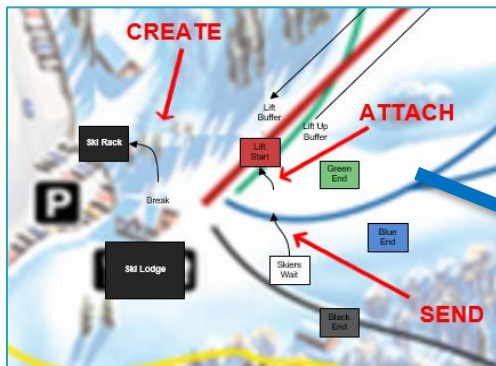
- Fixture
- Redo
- Work_Unit

Note: The Only way to give an Entity a new name is in Percentage & certain Conditional Routings! -- Conditions based on Attribute & Variable values allow Entity name changes but the Entity Name condition does not.

Demo 3: Ski Resort Model with Multiple Routing Types

This model uses these Routings:

- Percentage
- Conditional
- Attach
- Detach
- Create
- Send



4. Resources & How to Use Them

Poll #3



Process
simulator

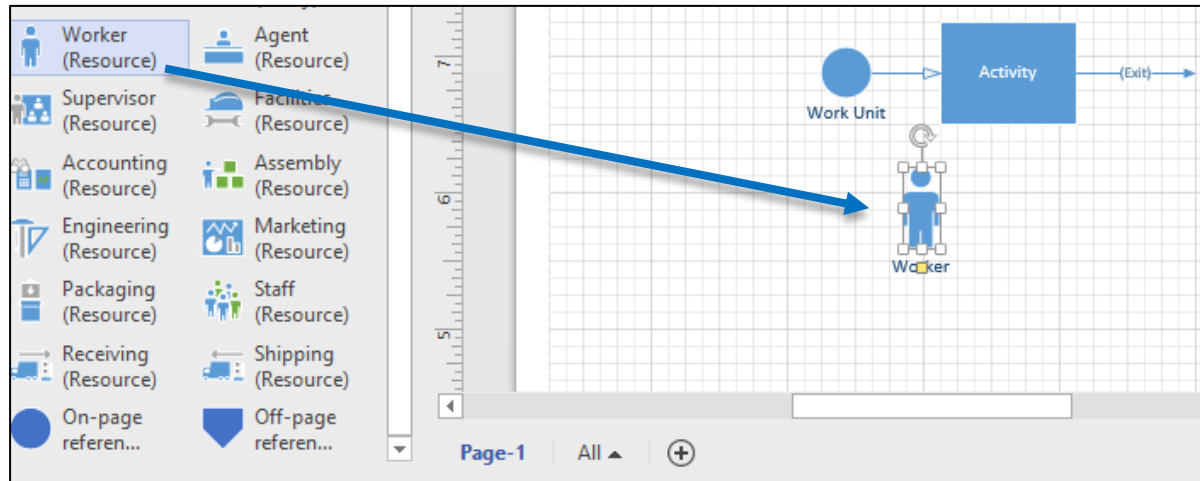
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Resources

- Left-click and drag your Worker Resource object from the Process Simulator stencil to your layout.



Use the Resource in an Activity

- To Use a Resource for an Activity: -
 - Enter the Shape Properties for that Activity
 - Select the desired resource from the drop-down list.
- Resources can also be captured during routings from one activity to another and can be held for several activities in a row (more on this later).
- *Note that you must have first placed a resource on the screen in order for it to appear as an option in the drop-down list.*

The screenshot shows a 'Properties' dialog box with two tabs: 'ACTIVITY' and 'LOGIC'. The 'ACTIVITY' tab is selected. The dialog contains the following fields and controls:

- Name: Activity (with a lock icon)
- Capacity: 1
- Buffers: In: 999, Out: 0
- Time: T(3, 5, 10) (with a 'Min' dropdown)
- Multi Entity: Define (button)
- Hourly Cost: 0
- Resource** (expanded section, highlighted with a blue border):
 - Name: (empty dropdown)
 - Priority: 0 (dropdown)
 - Keep:

Controlling Resources

- When we need a Resource, we have been specifying it by name in the Resource drop-down list.
- If we need a Resource for multiple steps there are additional ways we can more precisely control when we *capture* and *release* Resources:
 - Keep (checkbox)
 - Get (in Logic)
 - Free (in Logic)

The screenshot shows the 'Properties' dialog box with two tabs: 'ACTIVITY' and 'LOGIC'. The 'LOGIC' tab is selected. The 'Name' field is 'Rework' with a lock icon. The 'Capacity' field is '1'. The 'Buffers' section has 'In: 999' and 'Out: 0'. The 'Time' field is 'T(2, 7, 15)' with a 'Min' dropdown. The 'Multi Entity' field has a 'Define' button. The 'Hourly Cost' field is '0'. Below this is a section for 'Resource' with a dropdown arrow. The 'Name' field is 'Worker_2' with a dropdown arrow. The 'Priority' field is '0' with a dropdown arrow. The 'Keep' checkbox is checked and highlighted with a blue border.

Name:	Rework
Capacity:	1
Buffers:	In: 999 Out: 0
Time:	T(2, 7, 15) Min
Multi Entity:	Define
Hourly Cost:	0
Resource:	Worker_2
Priority:	0
Keep:	<input checked="" type="checkbox"/>

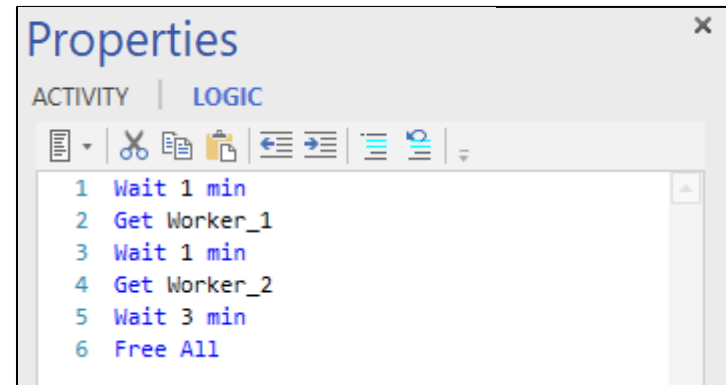
Freeing a Kept Resource

- If we select the Keep checkbox in an Activity or Routing dialog, the selected Resource will stay with the Entity for subsequent process steps.
- At some downstream step, the Entity **MUST** release the Resource, by one of two methods:
 1. Select again the name of the resource in the drop down but without checking the “Keep” option.
 2. Use a Free statement in Activity or Routing Logic.

The screenshot shows the 'Properties' dialog box for an 'ACTIVITY' or 'LOGIC' step. The 'Name' field is set to 'Primer'. The 'Capacity' is 1. The 'Buffers' section shows 'In: 999' and 'Out: 0'. The 'Time' is set to 'T(3, 4, 5)' with a 'Min' dropdown. The 'Multi Entity' section has a 'Define' button. The 'Hourly Cost' is 0. The 'Resource' section has a 'Name' dropdown and a 'Priority' dropdown, both currently empty. The 'Keep' checkbox is checked and is highlighted with a red box. The 'Availability' section is collapsed.

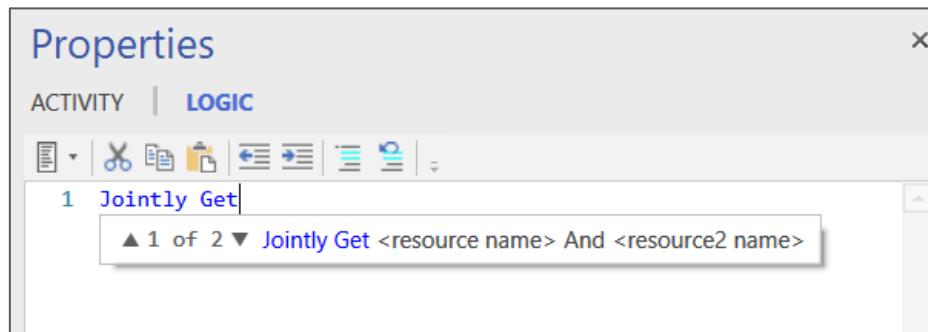
Get and Free Statements

- If we need more precise control over when we capture and release Resources within an Activity, we can use the Get and Free statements.
- **Get** issues a request to capture the Resource (there may be delays based on Resource availability). Once the Get statement is satisfied (the Resource is captured), the Entity will proceed to the next line of logic.
- **Free** will immediately free the listed Resource
- For example:



```
Properties
ACTIVITY | LOGIC
1 Wait 1 min
2 Get Worker_1
3 Wait 1 min
4 Get Worker_2
5 Wait 3 min
6 Free All
```

Jointly Get

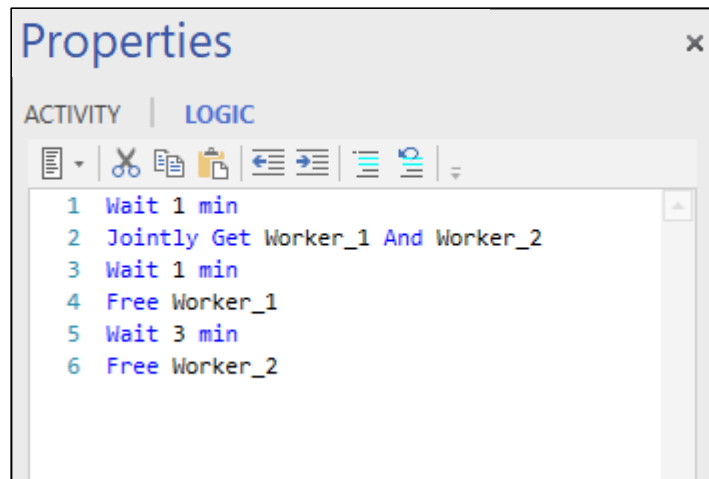


Properties

ACTIVITY | LOGIC

1 Jointly Get

▲ 1 of 2 ▼ Jointly Get <resource name> And <resource2 name>



Properties

ACTIVITY | LOGIC

- 1 Wait 1 min
- 2 Jointly Get Worker_1 And Worker_2
- 3 Wait 1 min
- 4 Free Worker_1
- 5 Wait 3 min
- 6 Free Worker_2

Use Statement

- The Use statement is a method to capture a Resource in the logic, Use it for a defined length of time, then Free the Resource. This works the same as separate Get, Wait, & Free statements.
- Syntax:
Use <Resource Name> For <duration> <units>
- If there are multiple process steps taking place within one Activity, this is a more detailed way to control the sequence Resources are actually captured and freed.

Properties

ACTIVITY | LOGIC

Name: Oven_1

Capacity: 1

Buffers: In: 999 Out: 999

Time: 60 Min

Multi Entity: Define

Hourly Cost: 0

Resource

Name: Worker_1

Priority: 0

Keep:

Availability

Batching

Setup

Downtimes

Notes

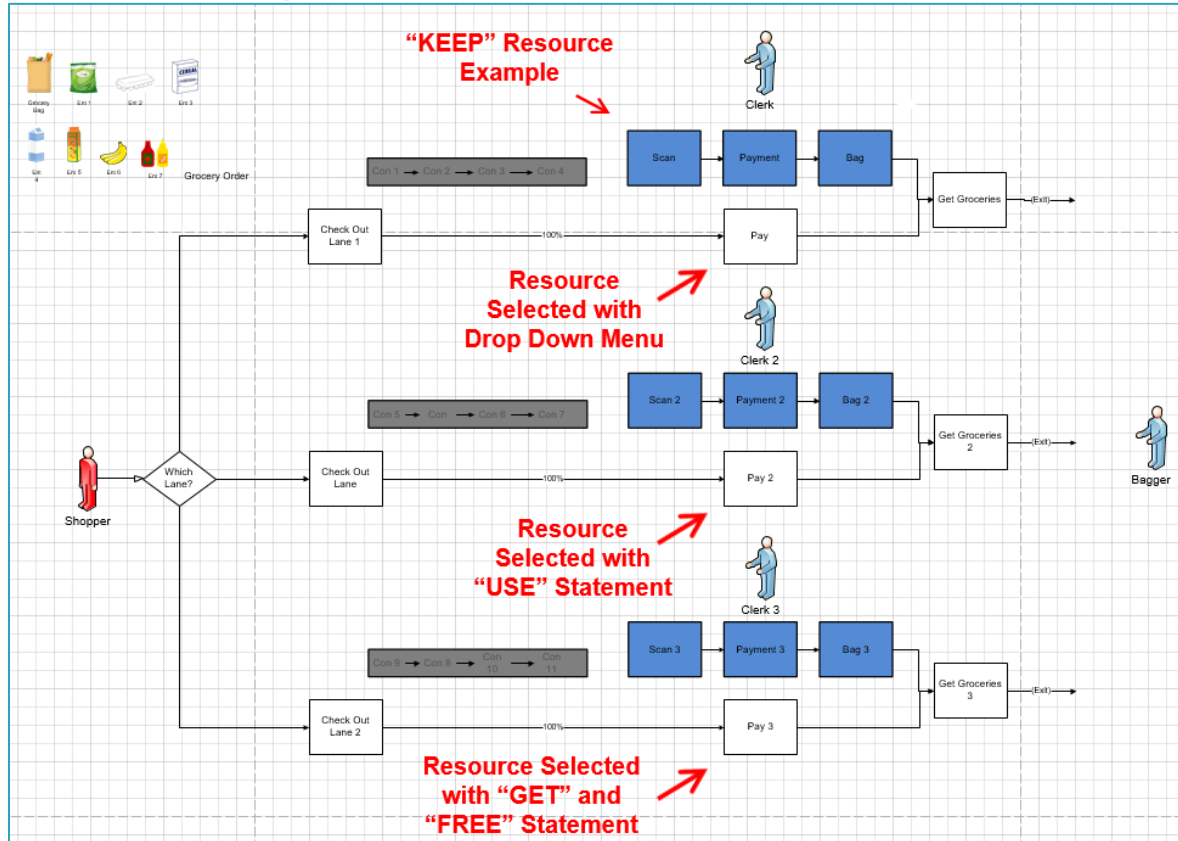
Advanced

Properties

ACTIVITY | LOGIC

```
1 Use Worker_1 For N(3, 0.1) min
2
```

Demo 4: Grocery Store with Resources in Use



10 Minute Break

Webinar will resume at 2:40 pm ET



5. User-Defined Expressions



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Variables

- Hold a numeric value
- Integer or Real
- May be displayed on the screen
- Initial value specified in the Variables and Attributes window (see next slide)

0000

Number
Completed

0000

Number
Rejected

0000

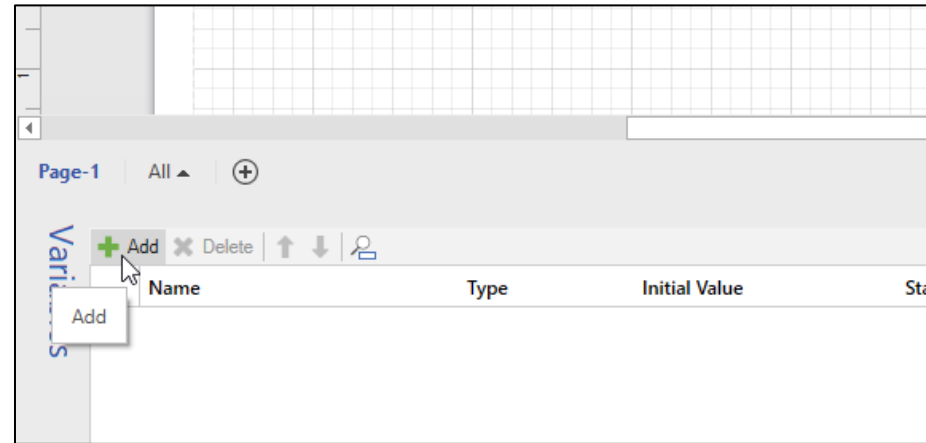
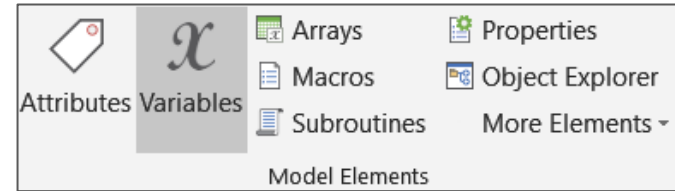
Work in
Process

0000

Cycle Time
(minutes)

Variables

1. Select the Variables Button from the Ribbon in the Model Elements section to open the Variable Grid
2. Click on the Add + button create a new variable
3. Edit Variable name
4. Type may be Integer or Real
5. Specify Initial Value



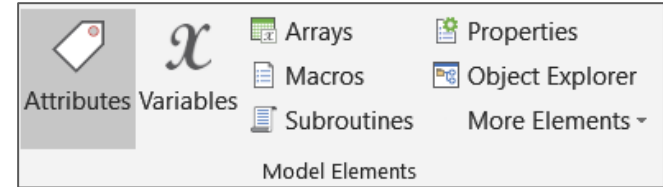
Attributes

- Used for identifying entities during processing or for tracking certain statistics.
- Not global—value is held by each entity independently.
- Initial value assigned to all entities as they enter the system.
- May be Real or Integer.



Attributes

1. Click on the Attribute Button to open the Attribute Grid. Like Variables, you can click on the Add + button to add a new Attribute
2. Edit attribute name
3. Type may be Integer or Real
4. Specify Initial Value



A screenshot of the 'Attributes' grid interface. On the left side, the word 'Attributes' is written vertically in blue. The grid has a header row with three columns: 'Name', 'Type', and 'Initial Value'. Above the grid, there are control buttons: a green plus sign for 'Add', a grey X for 'Delete', and up/down arrows. A person icon is also present. The grid body is currently empty.

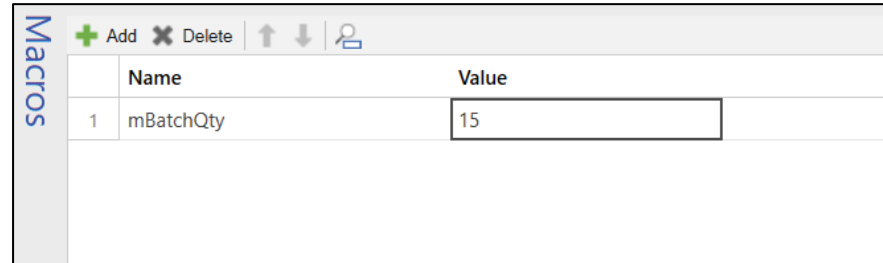
Name	Type	Initial Value
------	------	---------------

Macros

- A Macro is an element which can represent a number or a distribution that might be used repetitively throughout your model.
- Macros can be used as parameters in the Scenario Manager for scenario analysis.
- The Macros table can be found in the Model Elements section or the Process Simulator 2019 ribbon.
- Define the Macro (in the Macros Grid) and then enter the Macro in Activity Properties or logic, for example.
- When you want to change a Macro value, do so in the Macros table or, if it's a temporary change, you can modify it in the Scenario Manager.

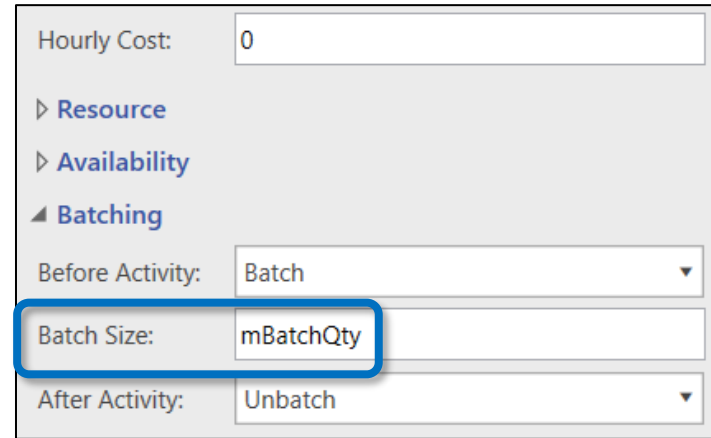
Macros Examples

- Here a Macro expression has been created representing the number of parts to be Batched at Oven1.
- The Macro is then used in the Entity Batching dialog at Oven1.
- And as a Scenario Parameter within Scenario Manager.



The screenshot shows a 'Macros' dialog box with a table. The table has two columns: 'Name' and 'Value'. There is one row with the name 'mBatchQty' and the value '15'. The 'Value' cell is highlighted with a blue border. Above the table are icons for '+ Add', 'x Delete', and up/down arrows.

	Name	Value
1	mBatchQty	15



The screenshot shows the 'Batching' section of a dialog box. It includes a 'Batch Size' field with the value 'mBatchQty' highlighted by a blue border. Other fields include 'Hourly Cost' (0), 'Before Activity' (Batch), and 'After Activity' (Unbatch). There are expandable sections for 'Resource', 'Availability', and 'Batching'.

Hourly Cost: 0

▶ Resource

▶ Availability

▲ Batching

Before Activity: Batch

Batch Size: mBatchQty

After Activity: Unbatch

Which Expression to Use?

Expression	Definition	Use When	Notes
Attribute	Integer or Real number	<ul style="list-style-type: none">Entity characteristic determines action or routeNeeded along with a Variable to track items	<ul style="list-style-type: none">Not Global; they are independent to each EntityNo Output Viewer Stats!Exist only during model run
Macro	Number or Distribution	<ul style="list-style-type: none">Value is repeated multiple places in modelNeeded for Scenario parameterWant a single table to edit many expressions used in logic	<ul style="list-style-type: none">Global to entire modelNo Output Viewer Stats!Exist only during model runValue cannot be changed after model run begins!
Variable	Integer or Real number	<ul style="list-style-type: none">Counting itemsNeeded to trigger actionValue needs to change during model run	<ul style="list-style-type: none">Global to entire modelYes, Output Viewer Stats!Can be displayed onscreen

Demo 5: Airport Security Model with User Defined Expressions

VARIABLES

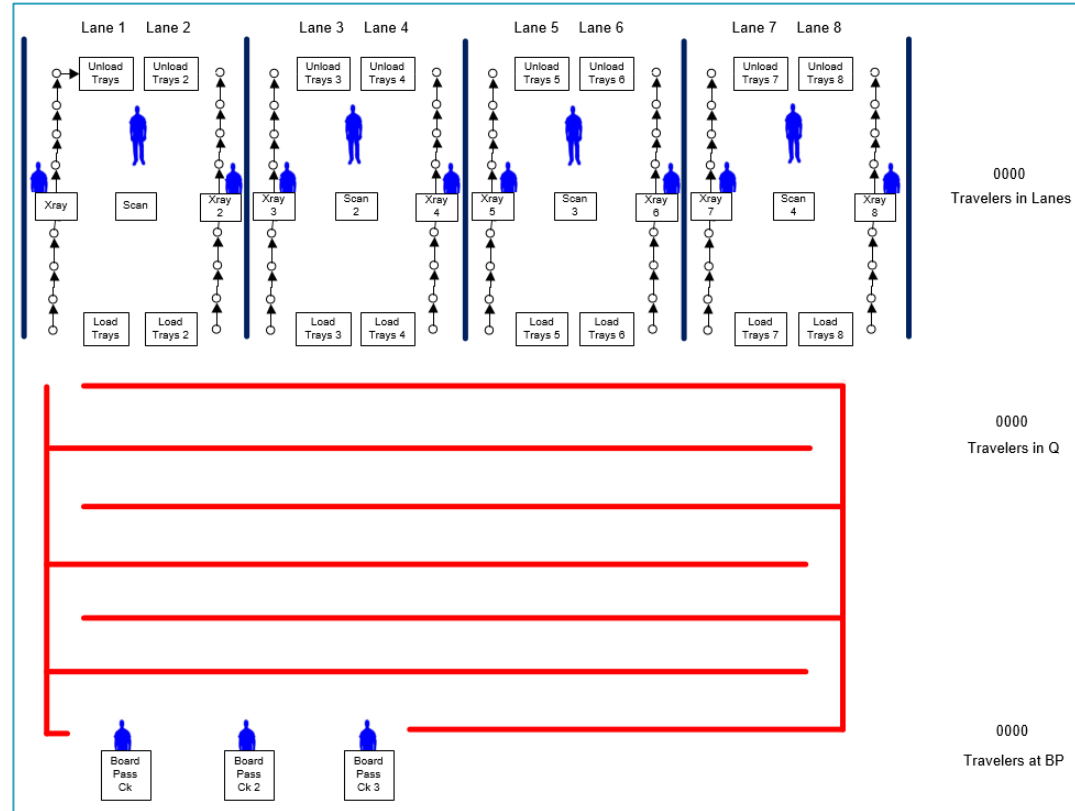
Name	Type	Initial Value	Statistics
vCount_thru_Ln1	Integer	0	Time Weighted
vCount_thru_Ln2	Integer	0	Time Weighted
vCount_thru_Ln3	Integer	0	Time Weighted
vCount_thru_Ln4	Integer	0	Time Weighted
vCount_thru_Ln5	Integer	0	Time Weighted
vCount_thru_Ln6	Integer	0	Time Weighted
vCount_thru_Ln7	Integer	0	Time Weighted
vCount_thru_Ln8	Integer	0	Time Weighted
vCount_ALL_Lns	Integer	0	Time Weighted
vLast_CT	Real	0	
vALL_CT_Bucket	Real	0	
vAvg_CT	Real	0	
vBP1	Integer	0	
vBP2	Integer	0	
vBP3	Integer	0	
vBP4	Integer	0	
vBP5	Integer	0	
vBP6	Integer	0	
vALL_BP	Integer	0	
vAll_O	Integer	0	

MACROS

Name	Value
mXray_Time_Sec	15
mScan_Time_Sec	15
mDT_1st_Time_Ln1	1
mDT_1st_Time_Ln2	2
mDT_1st_Time_Ln3	3
mDT_1st_Time_Ln4	4
mDT_1st_Time_Ln5	5
mDT_1st_Time_Ln6	6
mDT_1st_Time_Ln7	7
mDT_1st_Time_Ln8	8
mXray_Tech_Sec	N(10, 2)
mScan_Tech_Sec	N(10, 2)
mUnsched_DT_Freq	N(45, 10)
mMins_to_Keep_Closed_Ln1	30
mMins_to_Keep_Closed_Ln2	30
mMins_to_Keep_Closed_Ln3	30
mMins_to_Keep_Closed_Ln4	30
mMins_to_Keep_Closed_Ln5	30

Attributes

Name	Type	Initial Value
sScan_Lane	Integer	0
sClock_Start	Real	0
aRouter	Integer	0
aRoute_to_Exit	Integer	0



6. Output Viewer

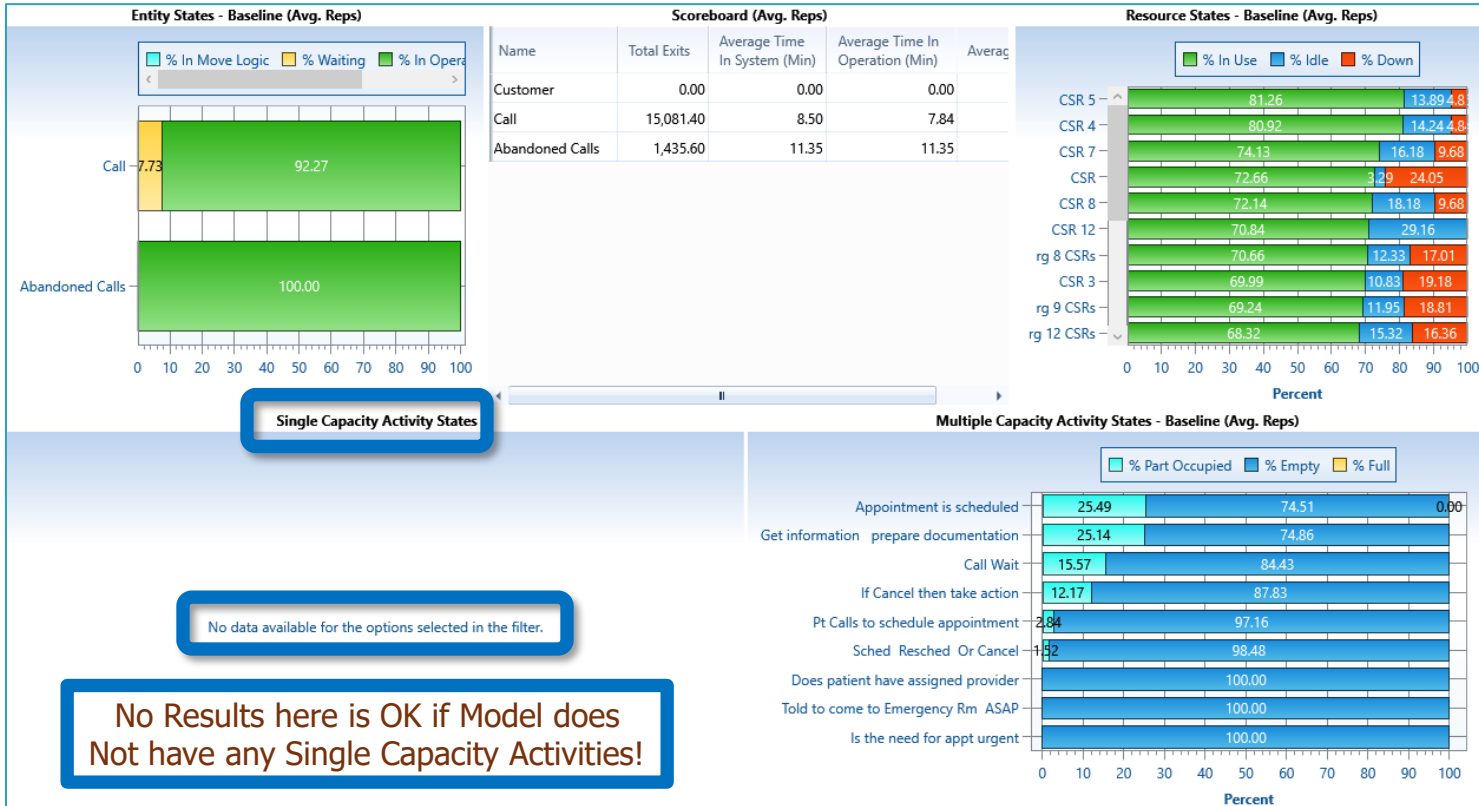


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About the Output Viewer

- A data file is generated every time a model runs
- The OV links to that file allowing data mining
- Use the OV to view different slices of data and examine the process model in detail
- Custom charts & tables can be built and saved so they populate with new data after each run
- TIP: Always determine some key process metrics early in a model project so you can compare output results later from different Scenarios

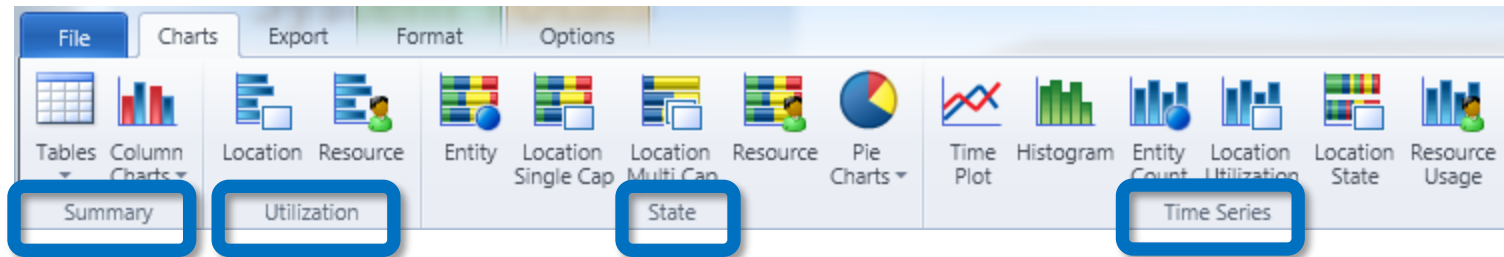
Results – Default View



No Results here is OK if Model does Not have any Single Capacity Activities!

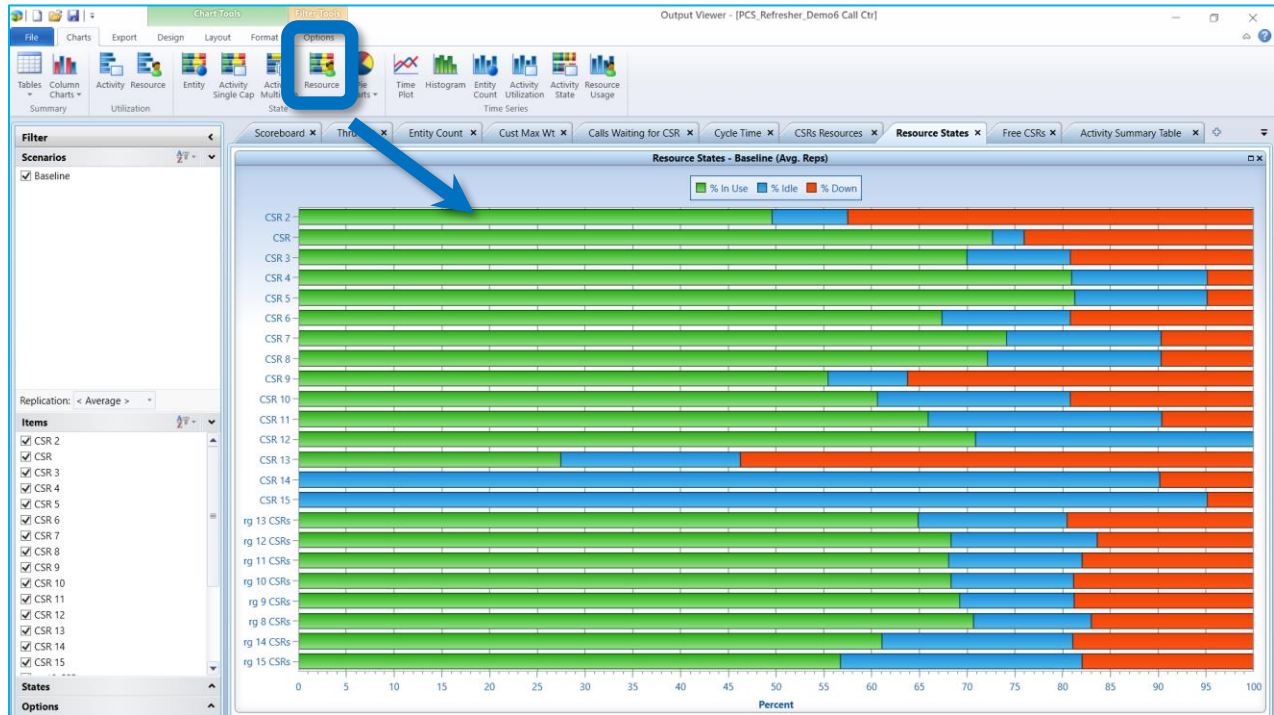
OV Chart Menu

- Summary – Tables & Column Charts
- Utilization – Activities & Resources
- State – Entities, Activities, & Resources
- Time Series – Data over the model run

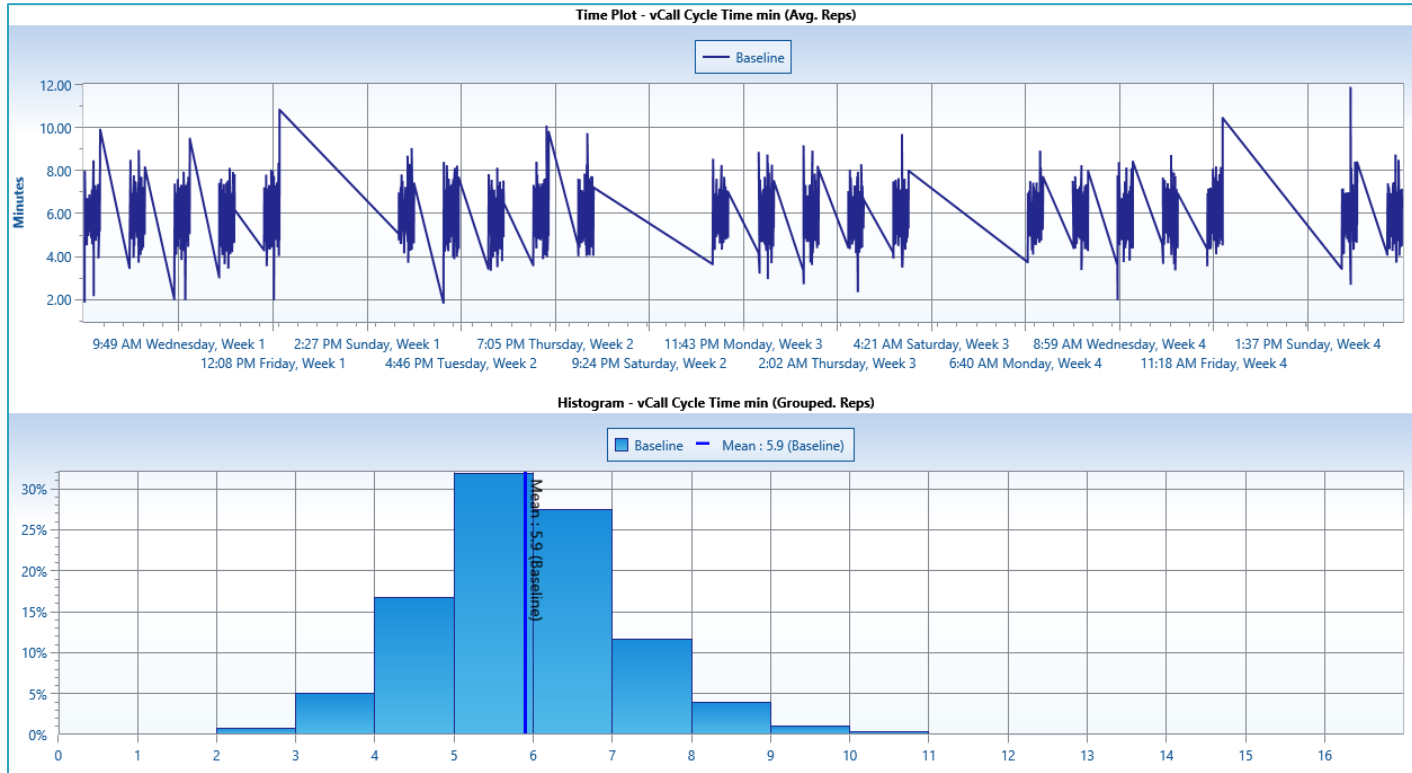


Create a Chart

- Click on a button to create a new chart

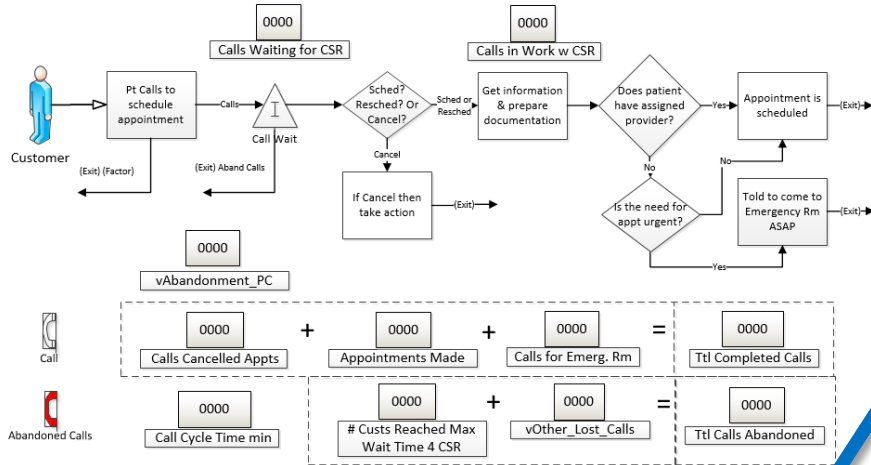


Output Views—User-Defined



Demo 6: Call Center Results in Output Viewer

Call Center to Schedule Patient Appointments



Activity Summary (Avg. Reps)

Name	Total Entries	Average Time Per Entry (Min)	Average Contents	Maximum Contents	Current Contents	% Utilization
Call Wait	16,517.00	2.67	1.00	27.00	0.00	0.00
Appointment is scheduled	13,418.60	3.86	1.22	13.00	0.00	9.42
Get information prepare documentation	13,557.20	2.88	0.92	11.60	0.00	7.09
Pt Calls to schedule appointment	16,517.00	0.08	0.03	6.40	0.00	0.00
If Cancel then take action	1,524.20	4.54	0.16	6.00	0.00	1.26
Sched Resched Or Cancel	15,081.40	0.07	0.03	5.20	0.00	0.20
Does patient have assigned provider	13,557.20	0.00	0.00	3.00	0.00	0.00
Is the need for appt urgent	1,345.60	0.00	0.00	1.20	0.00	0.00
Told to come to Emergency Rm ASAP	138.60	0.00	0.00	1.00	0.00	0.00

Resource Summary (Avg. Reps)

Scenario	Name	Units	Scheduled Time (Hr)	Work Time (Hr)	Number Times Used	Average Time Per Usage (Hr)	% Utilization
Baseline	CSR 5	1.00	164.68	133.82	1,363.60	0.10	81.26
Baseline	CSR 4	1.00	185.75	150.31	1,528.00	0.10	80.92
Baseline	CSR 7	1.00	165.04	122.35	1,242.40	0.10	74.13
Baseline	CSR	1.00	145.32	105.59	1,072.00	0.10	72.66
Baseline	CSR 8	1.00	165.12	119.12	1,209.80	0.10	72.14
Baseline	CSR 12	1.00	185.17	131.17	1,335.40	0.10	70.84

*Key Output Results you should Always analyze include:

- Throughput (i.e., Entity Exits)
- Cycle/Lead Time (process beginning to end)
- Work in Process (WIP)
- Activity & Resource Utilization

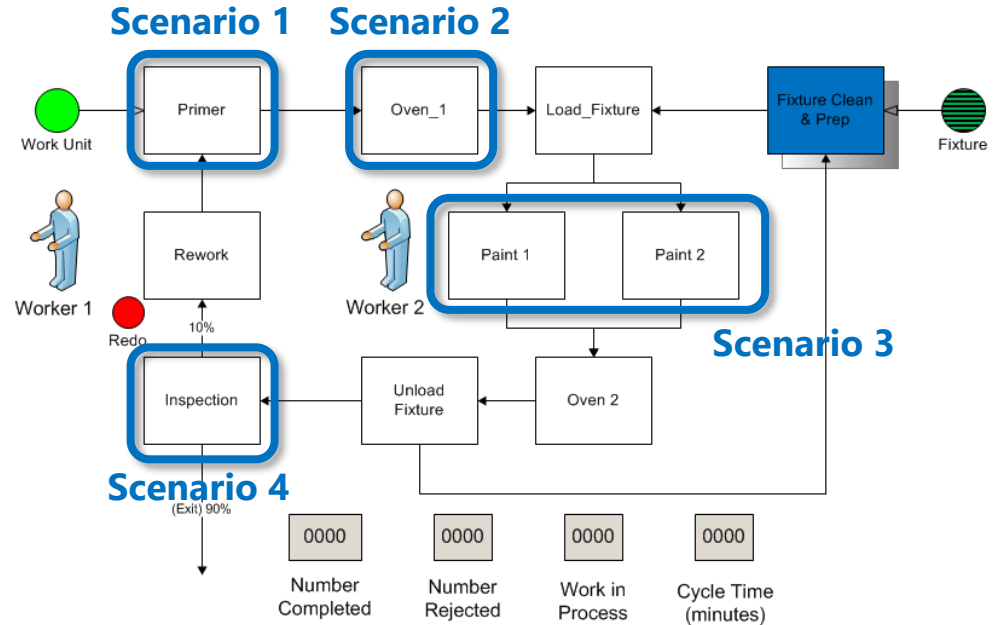
7. Scenarios



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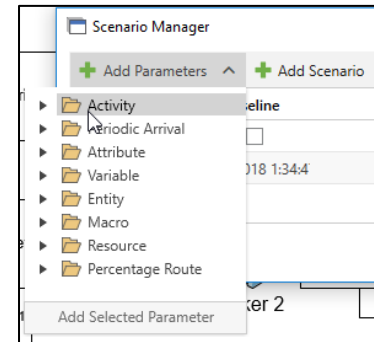
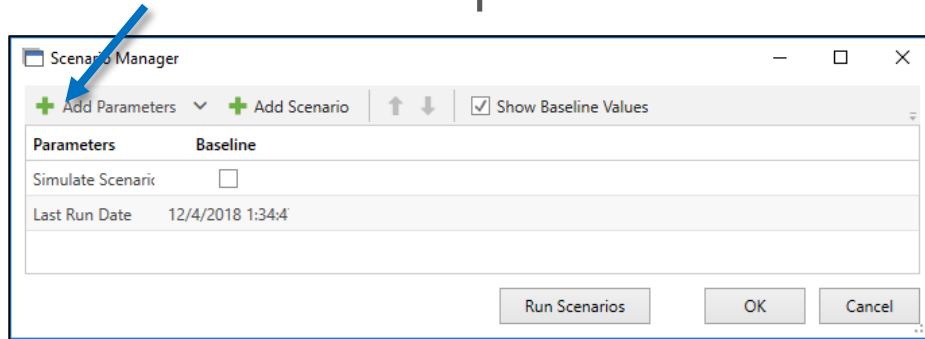
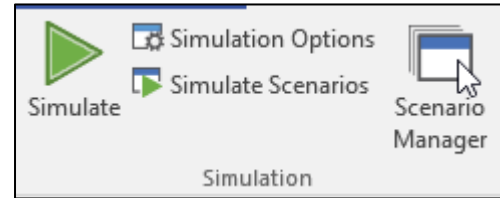
Scenarios

1. Reduce Primer Time
2. Alter Batch Size for Oven
3. Reduce Paint Booth Time
4. Reduce Rework Rate
5. All Improvements (Scen. 1 thru 4)



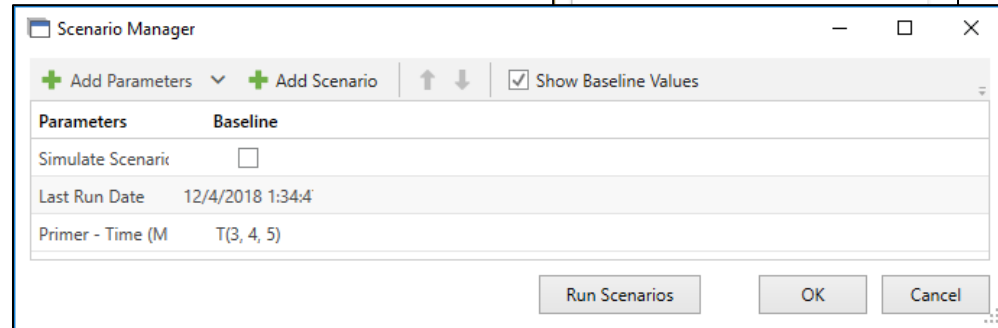
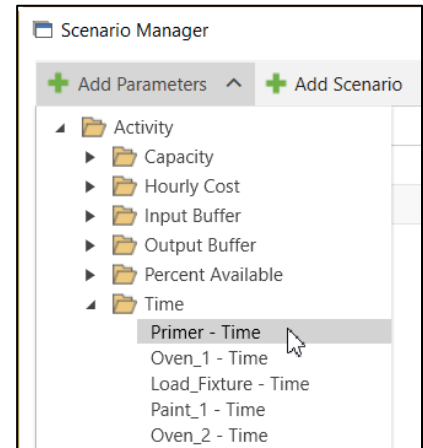
Scenario Manager

- Scenario Manager allows you to define the parameters that can be changed, then create Scenarios from those Parameters.
- Step 1. Click “Add Parameter” to create the list of parameters for experimentation.



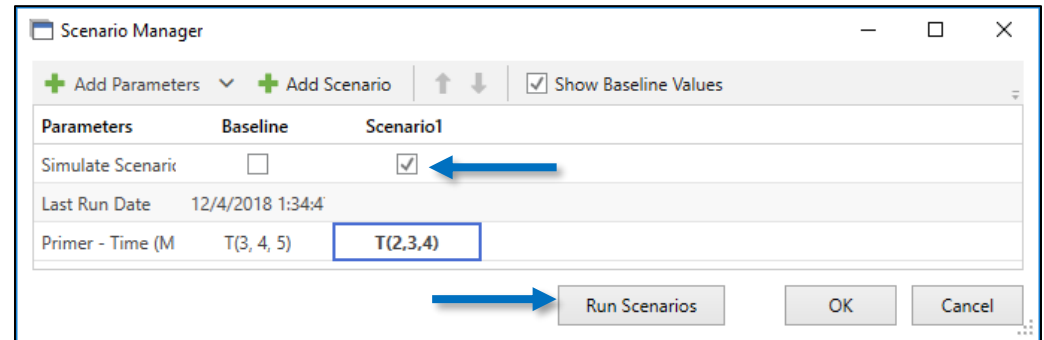
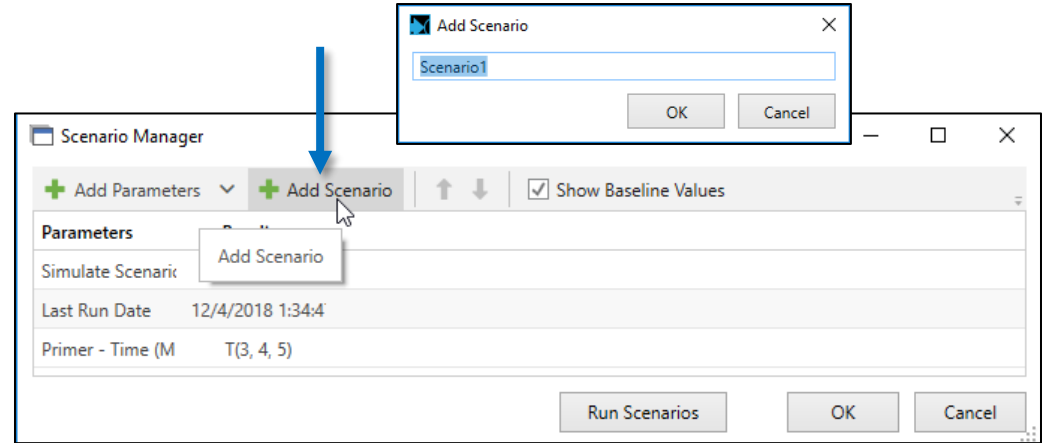
Adding Scenario Parameters

- Select each factor that you will be varying for experimentation.
- As the parameter is added, it appears in the Parameters column and default values appear in the Baseline scenario in Scenario Manager

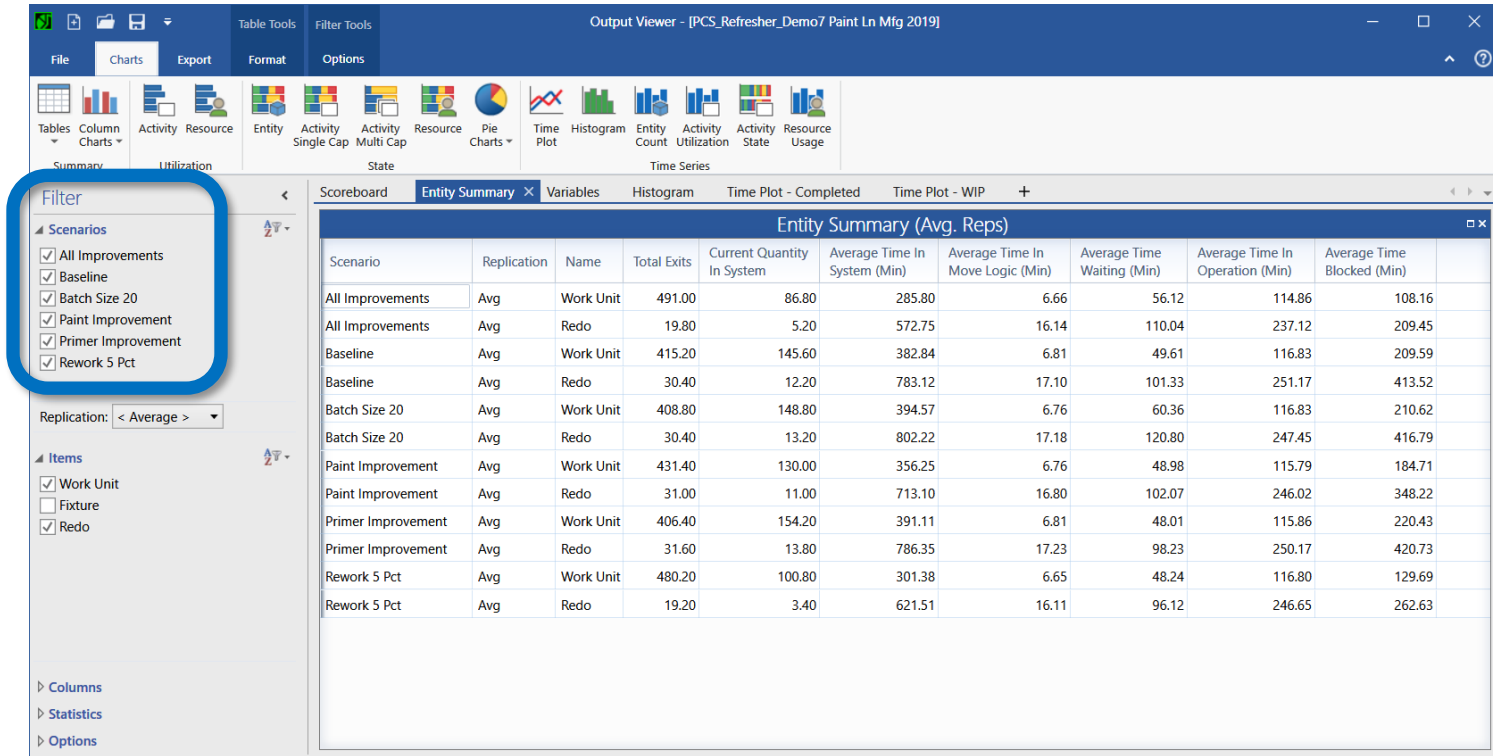


Simulate Scenarios

- Step 2. Click "Add Scenario" to create a scenario and define values for each parameter.
- You can enable or disable each scenario for comparison by selecting the check boxes.
- Run the enabled Scenarios by clicking the Run Scenarios button.



Scenario Analysis - Tables



Output Viewer - [PCS_Refresher_Demo7 Paint Ln Mfg 2019]

Table Tools | Filter Tools

File | Charts | Export | Format | Options

Tables | Column Charts | Activity | Resource | Entity | Activity Single Cap | Activity Multi Cap | Resource | Pie Charts | Time Plot | Histogram | Entity Count | Activity Utilization | Activity State | Resource Usage

Summary | Utilization | State | Time Series

Filter

Scenarios

- All Improvements
- Baseline
- Batch Size 20
- Paint Improvement
- Primer Improvement
- Rework 5 Pct

Replication: < Average >

Items

- Work Unit
- Fixture
- Redo

Columns

Statistics

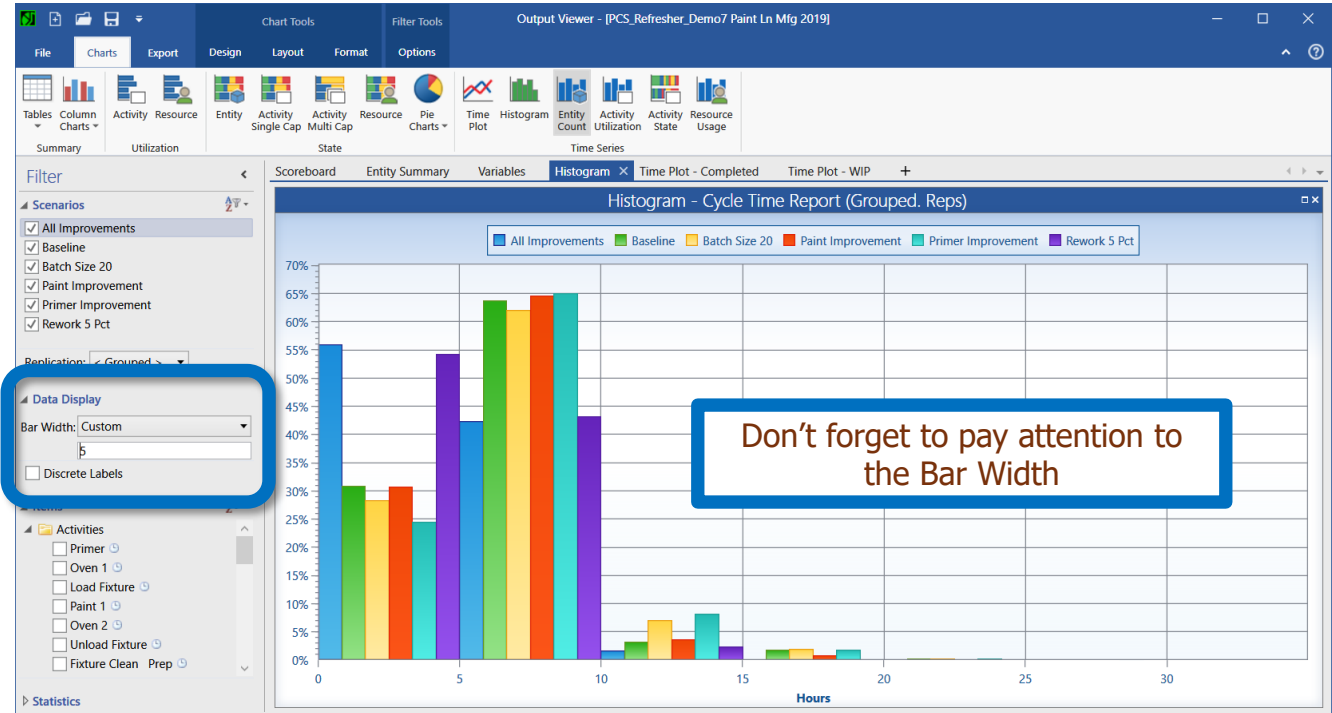
Options

Entity Summary (Avg. Reps)

Scenario	Replication	Name	Total Exits	Current Quantity In System	Average Time In System (Min)	Average Time In Move Logic (Min)	Average Time Waiting (Min)	Average Time In Operation (Min)	Average Time Blocked (Min)
All Improvements	Avg	Work Unit	491.00	86.80	285.80	6.66	56.12	114.86	108.16
All Improvements	Avg	Redo	19.80	5.20	572.75	16.14	110.04	237.12	209.45
Baseline	Avg	Work Unit	415.20	145.60	382.84	6.81	49.61	116.83	209.59
Baseline	Avg	Redo	30.40	12.20	783.12	17.10	101.33	251.17	413.52
Batch Size 20	Avg	Work Unit	408.80	148.80	394.57	6.76	60.36	116.83	210.62
Batch Size 20	Avg	Redo	30.40	13.20	802.22	17.18	120.80	247.45	416.79
Paint Improvement	Avg	Work Unit	431.40	130.00	356.25	6.76	48.98	115.79	184.71
Paint Improvement	Avg	Redo	31.00	11.00	713.10	16.80	102.07	246.02	348.22
Primer Improvement	Avg	Work Unit	406.40	154.20	391.11	6.81	48.01	115.86	220.43
Primer Improvement	Avg	Redo	31.60	13.80	786.35	17.23	98.23	250.17	420.73
Rework 5 Pct	Avg	Work Unit	480.20	100.80	301.38	6.65	48.24	116.80	129.69
Rework 5 Pct	Avg	Redo	19.20	3.40	621.51	16.11	96.12	246.65	262.63

Scenario Analysis - Charts

- Histograms (Cycle Time)



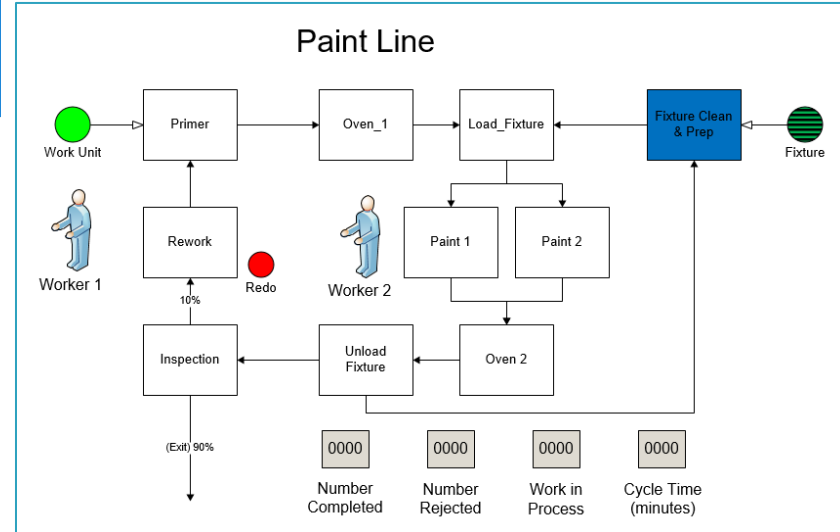
Demo 7: Paint Line Mfg with Multiple Scenarios

Scenario Manager

+ Add Parameters + Add Scenario ↑ ↓ Show Baseline Values

Parameters	Baseline	Primer Improvement	Paint Improvement	Batch Size 20	Rework 5 Pct	All Improvements
Simulate Scenario?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Last Run Date						
Primer - Time	T(3, 4, 5)	T(2, 3, 4)	T(3, 4, 5)	T(3, 4, 5)	T(3, 4, 5)	T(2, 3, 4)
Paint 1 - Time	N(8, 1)	N(8, 1)	N(7, 1)	N(8, 1)	N(8, 1)	N(7, 1)
Paint 2 - Time	N(8, 1)	N(8, 1)	N(7, 1)	N(8, 1)	N(8, 1)	N(7, 1)
mBatchQty - Value	15	15	15	20	15	20
Inspection TO EXIT - Percentage	90	90	90	90	95	95
Inspection TO Rework - Percentage	10	10	10	10	5	5

Run Scenarios OK Cancel



Poll #6

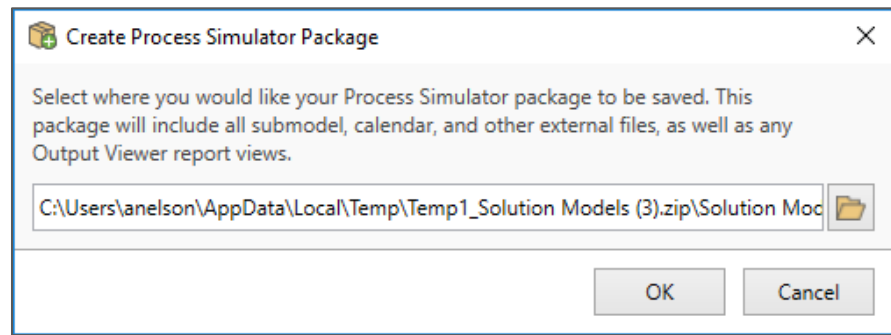
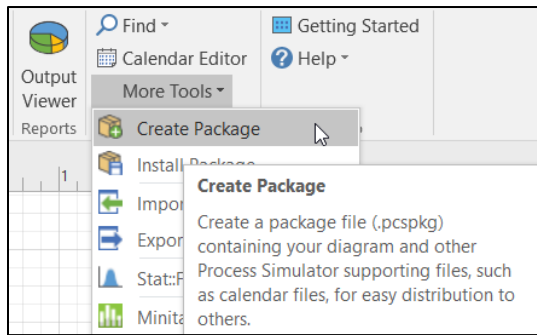
Wrap Up



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Creating Model Packages

- Sharing or archiving models is easy.
- Select “Create” from the “More Tools” dropdown on the Process Simulator Ribbon bar.
- This prompts you for a name for your model “Package.”



- A model package is saved with a .pcspkg extension and combines: the .vsd file, .pmcal files, and any other associated files.
- This .pcspkg file can then be copied or emailed to others. They can run the model by double clicking on the file name or “Install Package.”

Arrays

- An array is a matrix of values
- Each cell works like a variable
- A reference to a cell in an array can be used anywhere a variable can be used
- Refer to a specific array value by using the Array name followed by the specific value's row & column cell address.
- For example, the value 18 located above in row 2 and column 3 has a cell address of [2,3] so it would be referred to as Array1[2,3].

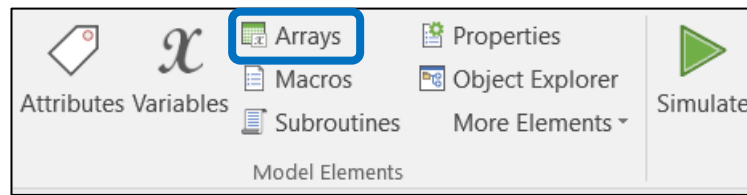
Array1:

	1	2	3	4
1	10	15	15	20
2	12	15	18	25
3	15	15	10	10

Array1 Cell Addresses:

Cell [1,1]	Cell [1,2]	Cell [1,3]	Cell [1,4]
Cell [2,1]	Cell [2,2]	Cell [2,3]	Cell [2,4]
Cell [3,1]	Cell [3,2]	Cell [3,3]	Cell [3,4]

Arrays



- Name and define in the Arrays Tab

	Name	Dimensions	Type	Import File	Export File	Disable	Data Between Reps	Notes
1	Array1	1, 1	Integer			None	Clear	

Name of the Array

Row and Column Dimensions

Allowed types:
Integer, Real, or Expression

Clear (re-import) or **Keep** array data between replications

Note: Arrays can be created by Importing directly from Excel files! Arrays can also be Exported to Excel files!

FINISHED

- Thanks for attending this PCS Refresher simulation course! We hope it was helpful.
- An online, self-paced, step-by-step PCS Essentials training course is also available. For more information, contact the ProModel Sales Director that works with your company.
- Remember, help is only an email or phone call away.
- Happy modeling!

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