# Process Simulator Tips & Techniques


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# Agenda

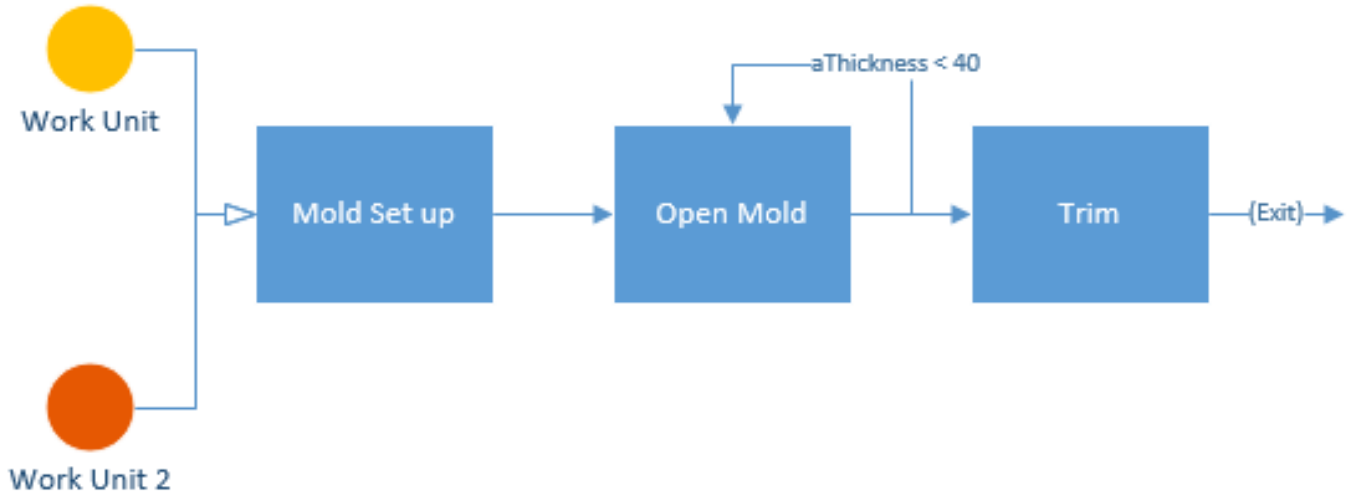
- Loops based on conditions
- Modeling Equipment & Facility as Resources
- Get vs. Jointly Get
- Using Priorities to Control Events
- Shift Carryover Functionality
- Default and Custom Batching Techniques

# Loops

- Repetitive processes such those in composites manufacturing or complex rework loops may require the use of loops.
- Loops will repeat a block of logic over and over again until a condition is met.

# Loops

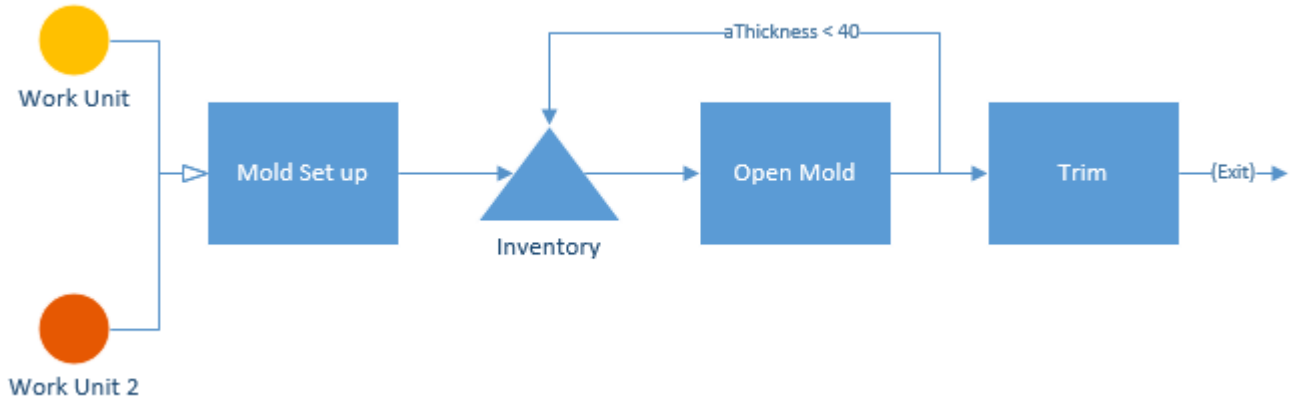
- Easy to lock up the model when a route comes out of an activity and goes back to the same activity.




Model File:
Loop 1.pspkg

# Loops

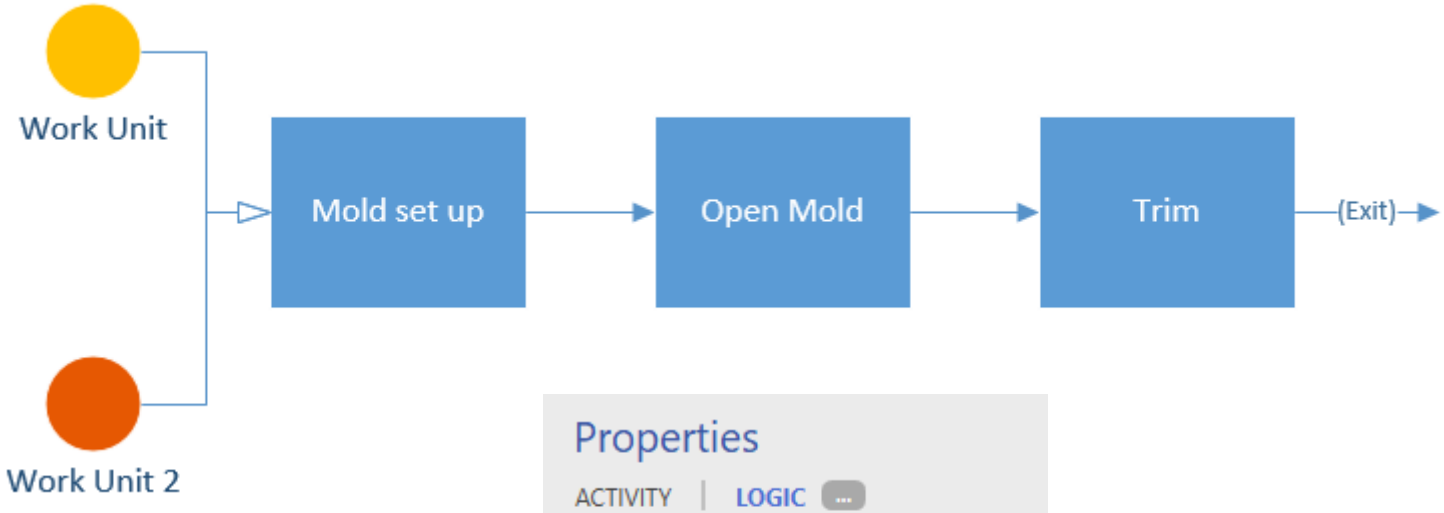
- A buffer can solve the model lock issue




Model File:
Loop 2.pspkg

# Loops

- A While Do loop can simplify the model




Properties

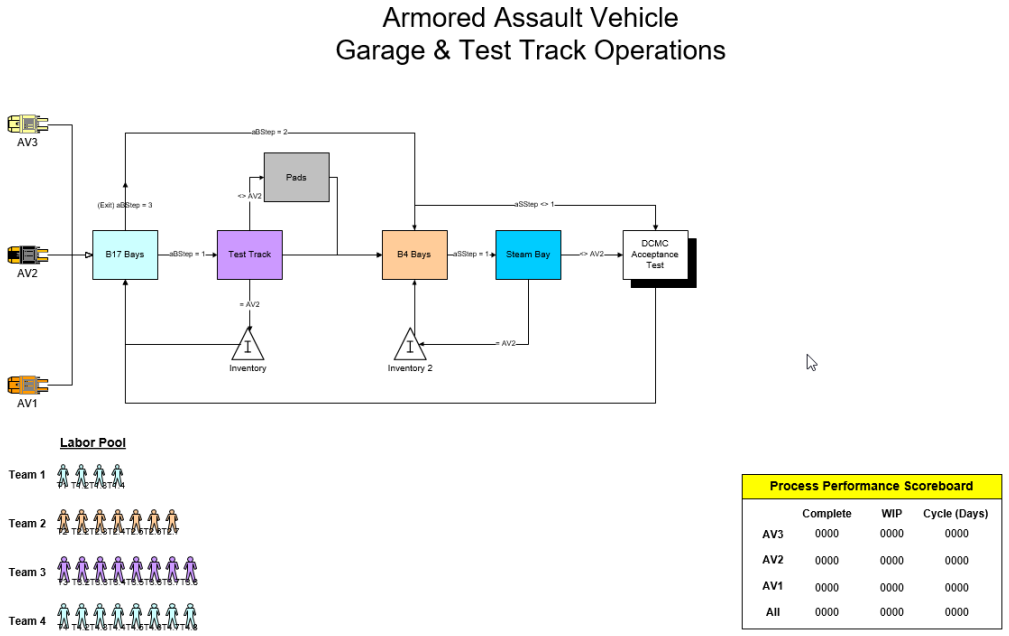
ACTIVITY | LOGIC ...

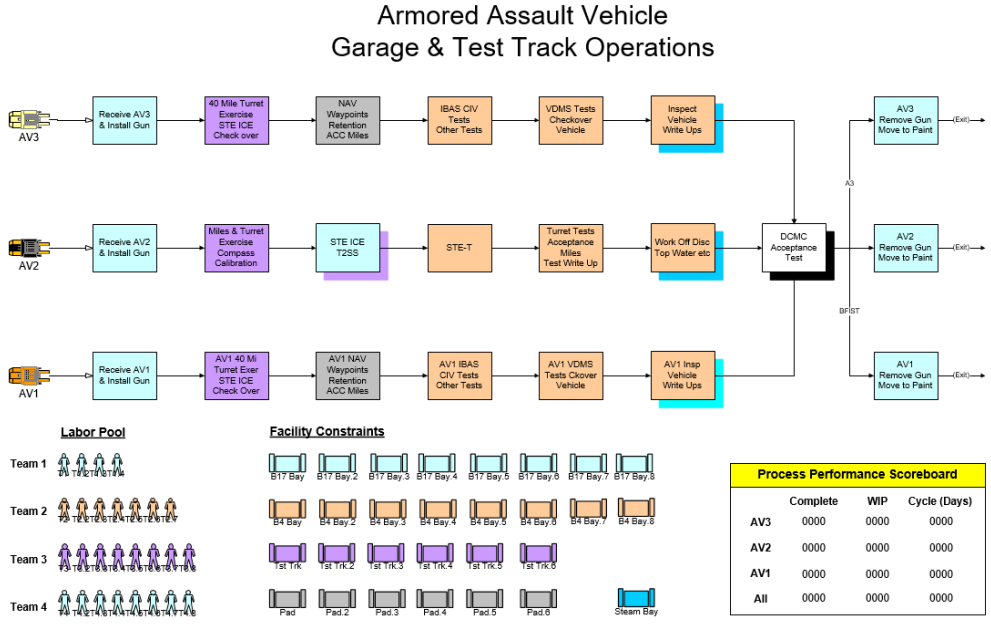
```
1  While aThickness < 40 Do
2  {
3      Wait 1 hr
4      inc aThickness, Rand(6)
5      Inc aLayer
6  }
```

Model File:
Loop 3.pspkg

# Activity Based vs Station Based

- Instead of modeling based on physical locations (Activity-based model) it can be beneficial in terms of complexity to create a model based on stations and model physical locations as resources

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# Get vs. Jointly Get

| Get Res1 and Res2 | Vs. | Jointly Get Res1 and Res2 |
| --- | --- | --- |
| Resources are captured Immediately if available | | Resources are only captured when all resources are available |

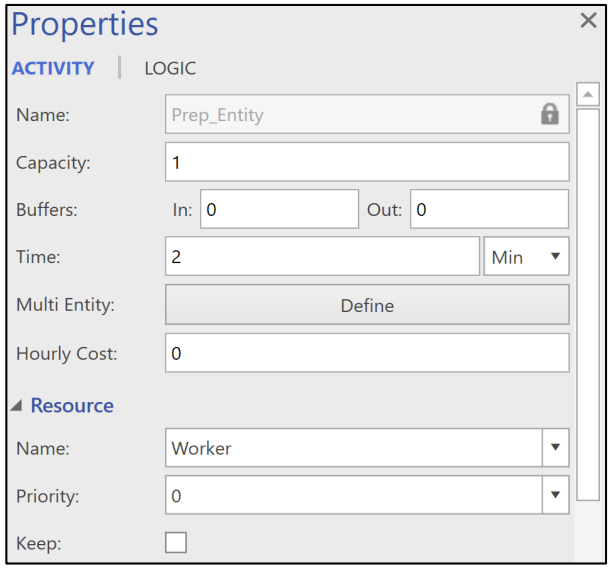
# Using Priorities to Control Events

- How and Where to Use Priorities
- Understanding Priority Levels for Resource Usage
- Entity & Downtime Control with Priorities

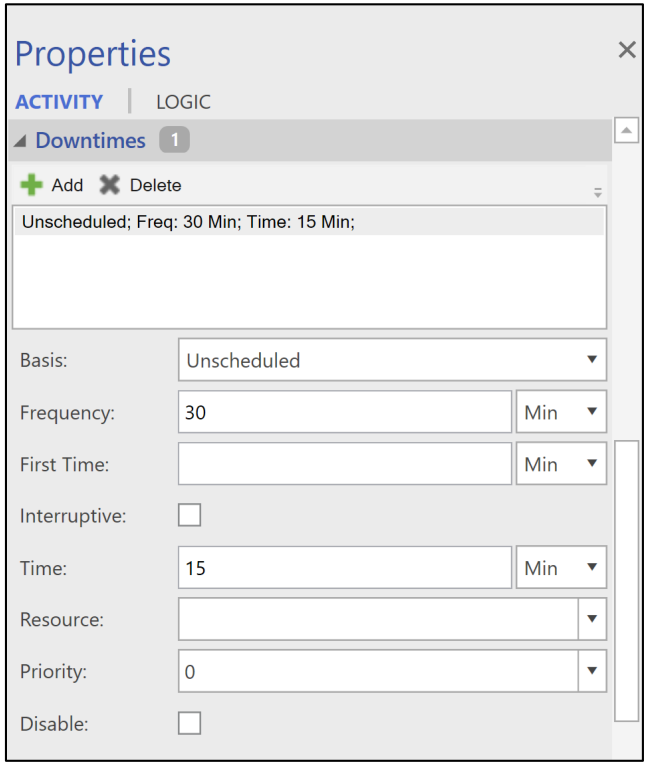
# Where to Use Priorities

- Activity & Routing Dialogs
  - Priority for capturing a Resource to perform an Activity or make a Move
    - Dialogs allow Levels 1-10, plus Interrupt

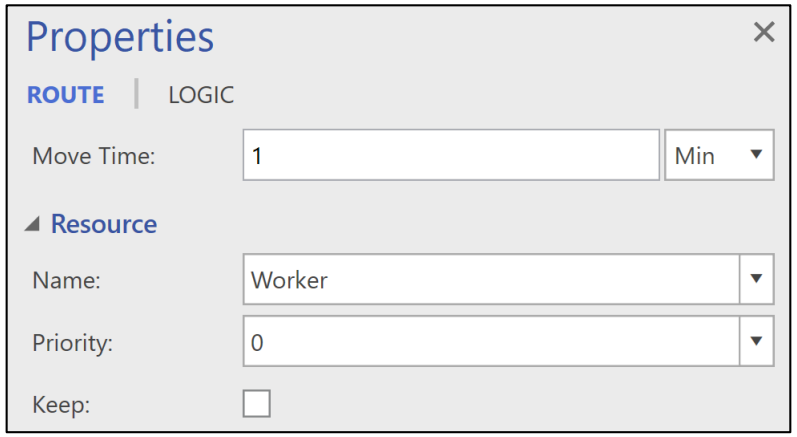
Activity




Activity Downtime




Routing

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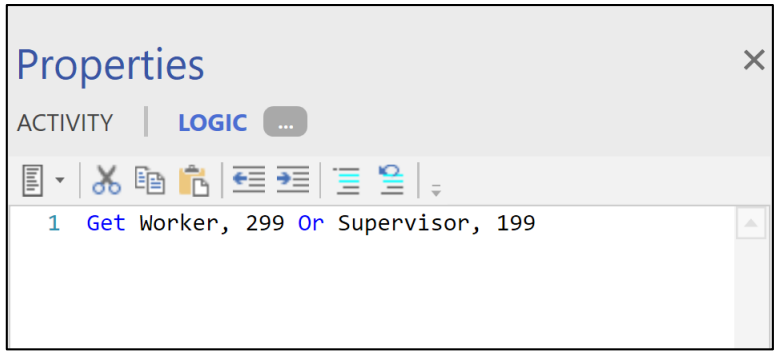
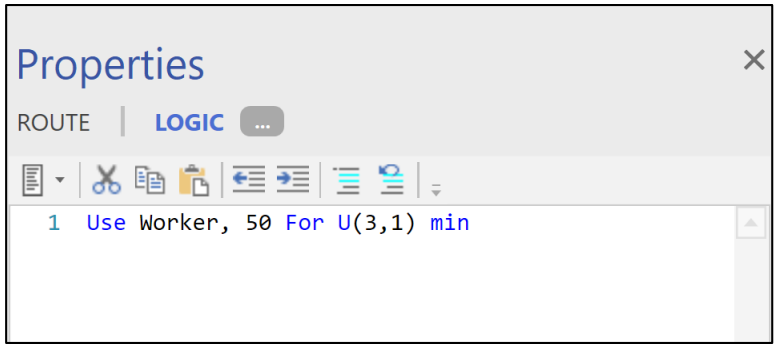
# Where to Use Priorities

- Activity & Routing Logic
  - Priority for capturing a Resource to perform an Activity or make a Move
    - Free Form Logic allows Levels 0-999

Activity Logic



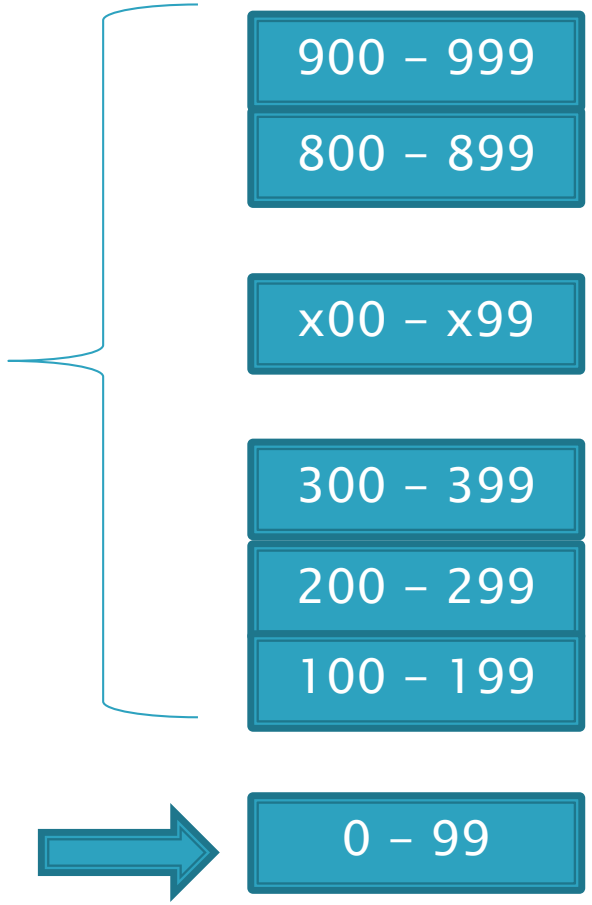

Routing Logic



# Understanding Priority Levels

Preemptive Priorities:
(i.e. can "takeover" another event that is currently in process)

Non-Preemptive Priorities:
Queue for processing According to priority Level, but cannot takeover Another event already in Process.




Queued entities with priorities that are at least 1 level higher than the current entity will preempt the entity that currently owns a resource.

In order to preempt a current downtime, a entity must have a priority level that is 2 levels higher than the DT priority.

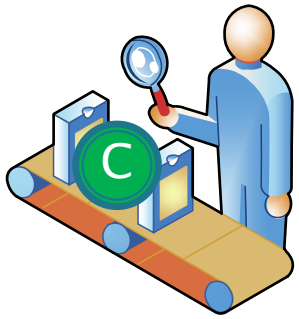
Queued downtimes with priorities that are at least 1 level higher than the current entity will preempt the entity that currently owns a resource.

# Events Queued for Resource Usage

Entity "Events" Queued for Inspector


Default Entity Priority Level is 0

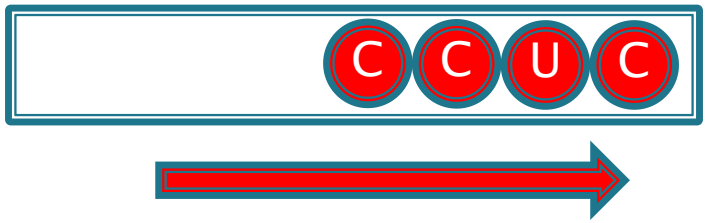
Note: Interrupt Entity Priority = 100




Inspection

Departing Events

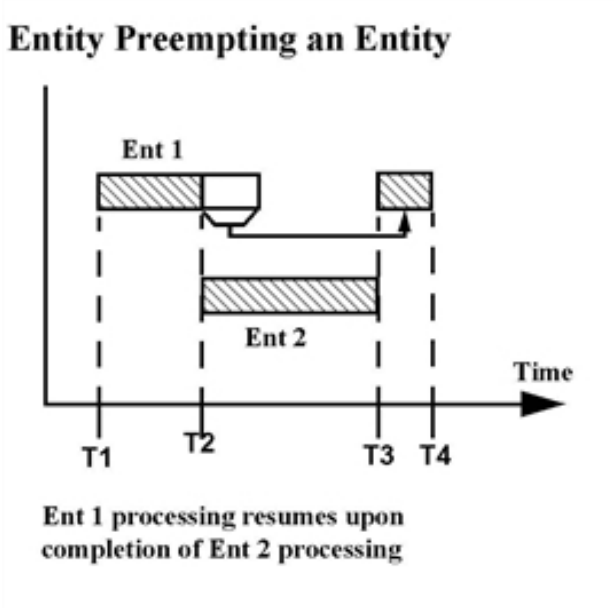

Downtime "Events" Queued to Occur



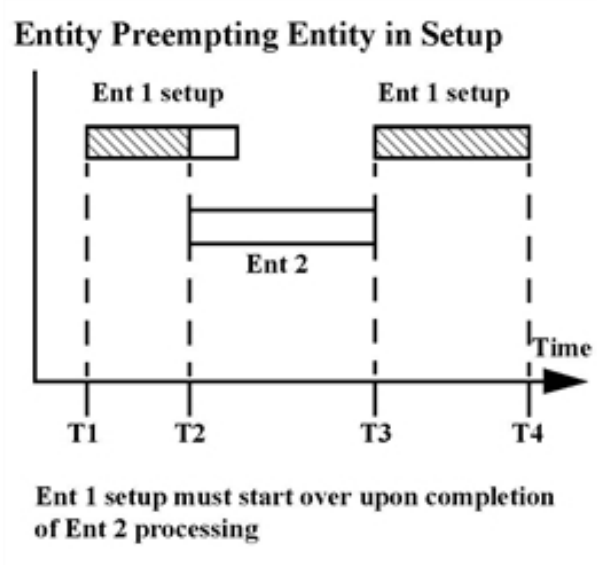

Default DT Priority Level is 99

Once a departing event frees a resource, priority levels on queued entities and downtime events determine the next event to capture the resource.

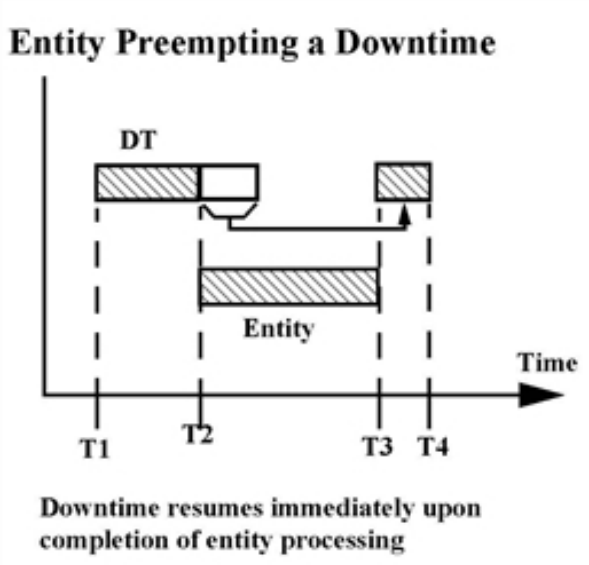
# Entities Preempting Other Events




Ent 1 Priority < 100
Ent 2 Priority >=100

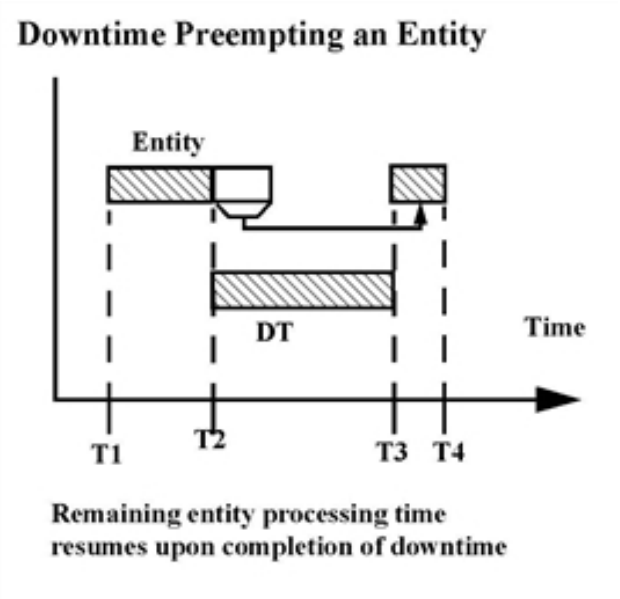



Ent 1 Priority < 100
Ent 2 Priority >=100

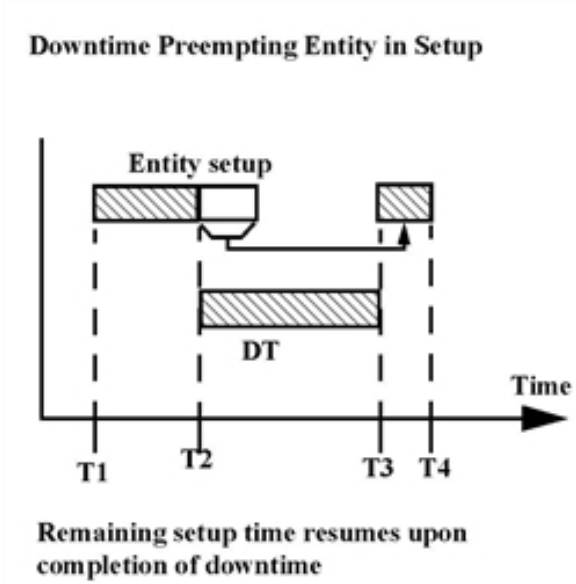



DT Priority < 100
Entity Priority >=200

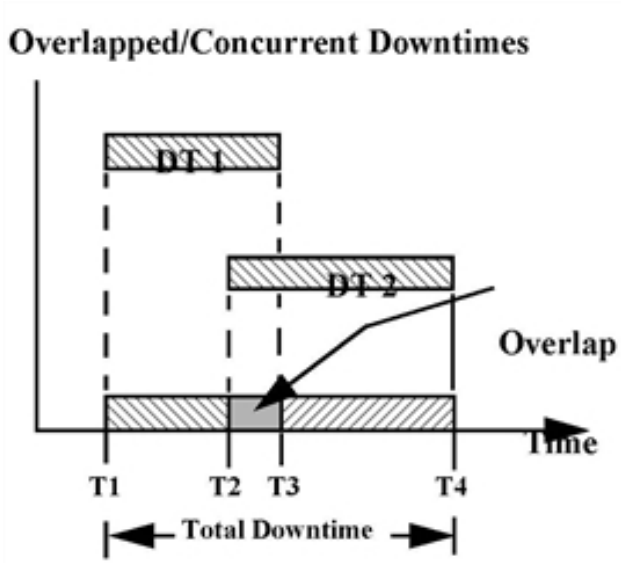
# Downtimes Preempting Other Events




Entity Priority < 100
DT Priority >=100




Entity Priority < 100
DT Priority >=100



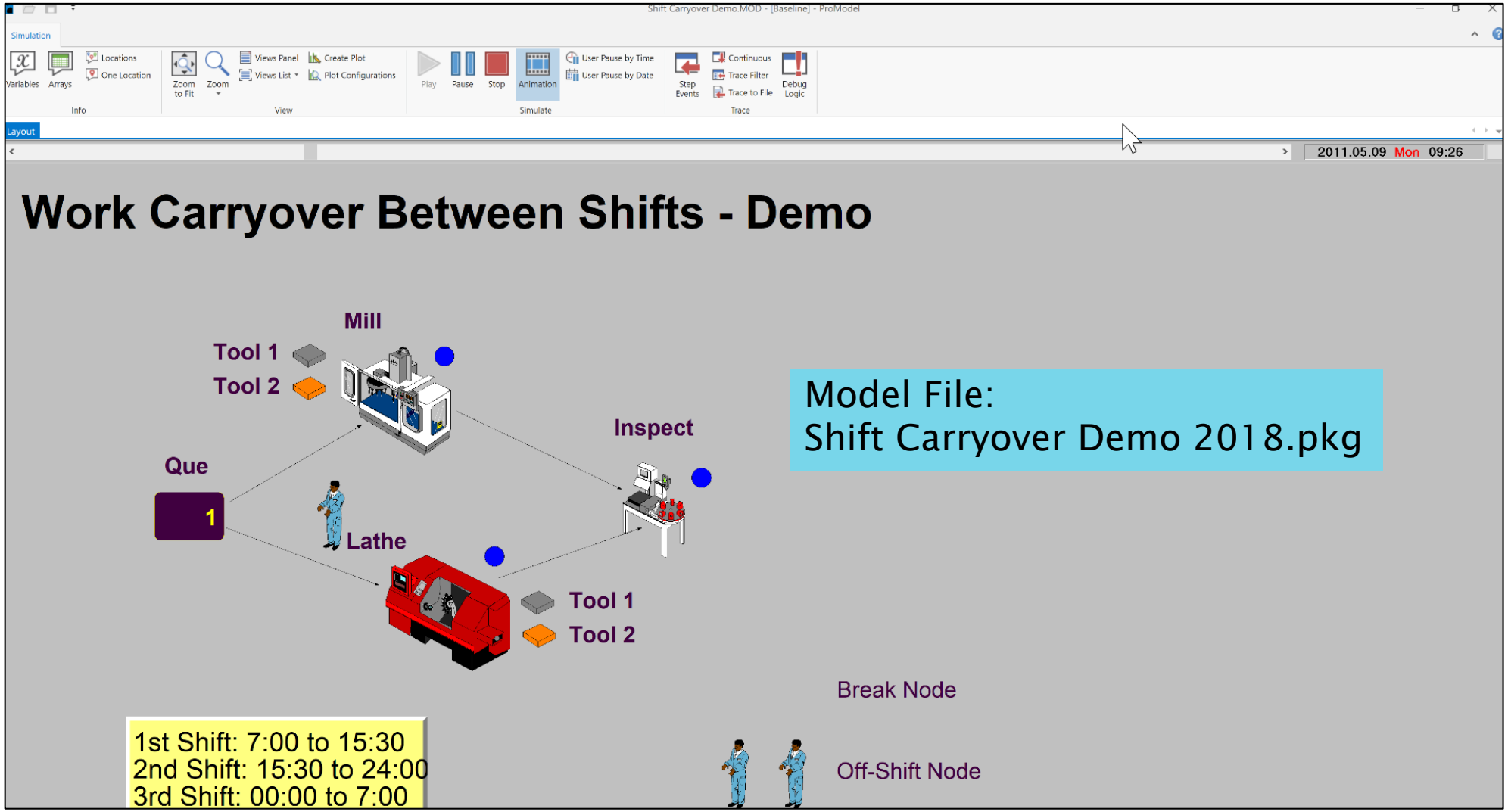

DT1 Priority < 100
DT2 Priority >=100

# Shift Carryover Functionality

- What is Shift Carryover?
  - Allows for a resource unit coming on shift to take over processing an entity for a resource unit going off shift.
  - Only works for Resources having multiple units.
    - There must be 1 or more units assigned to each shift.
  - Does not work between multiple, named resources.

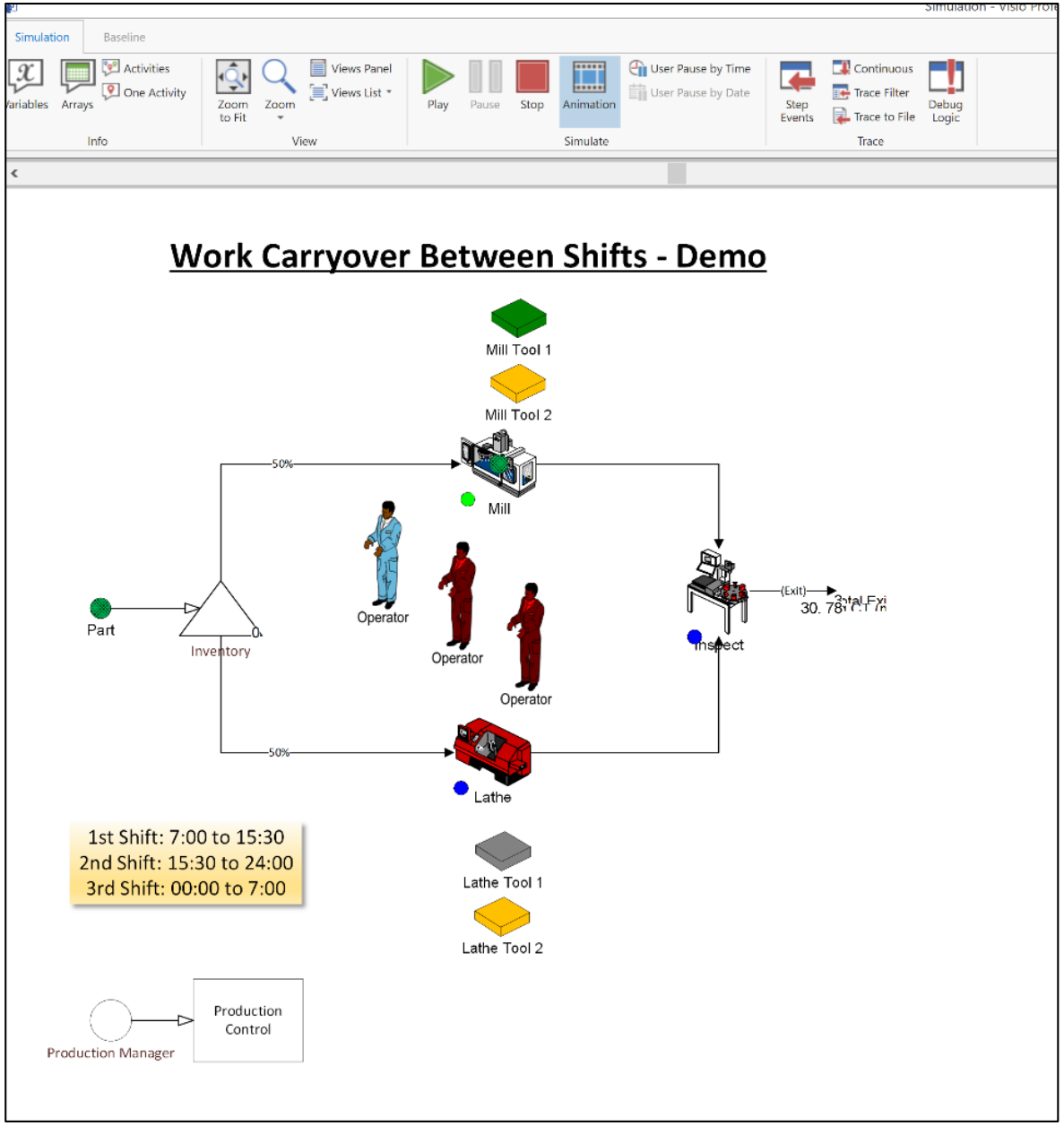
- ProModel Demo Model
- Process Simulator Demo Model

ProModel demo allows us to see Resources move whenever a shift change occurs.



Model File:
Shift Carryover Demo PCS 2019.pspkg

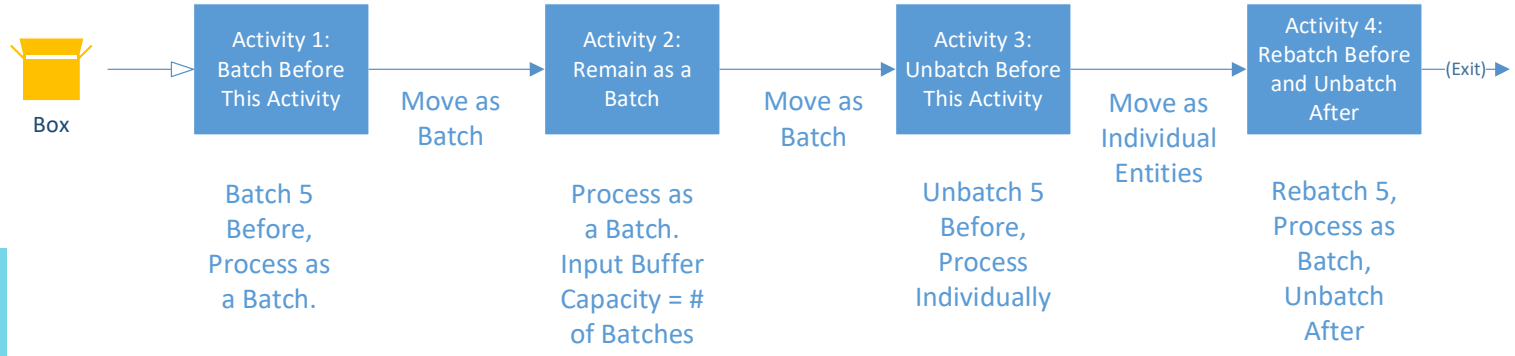
Process Simulator does not have mobile resources, but we can still see processing control change from one unit of a resource to another when a shift change occurs. Resource units that are red are off-shift.



# Default Rules for Batch/Unbatch

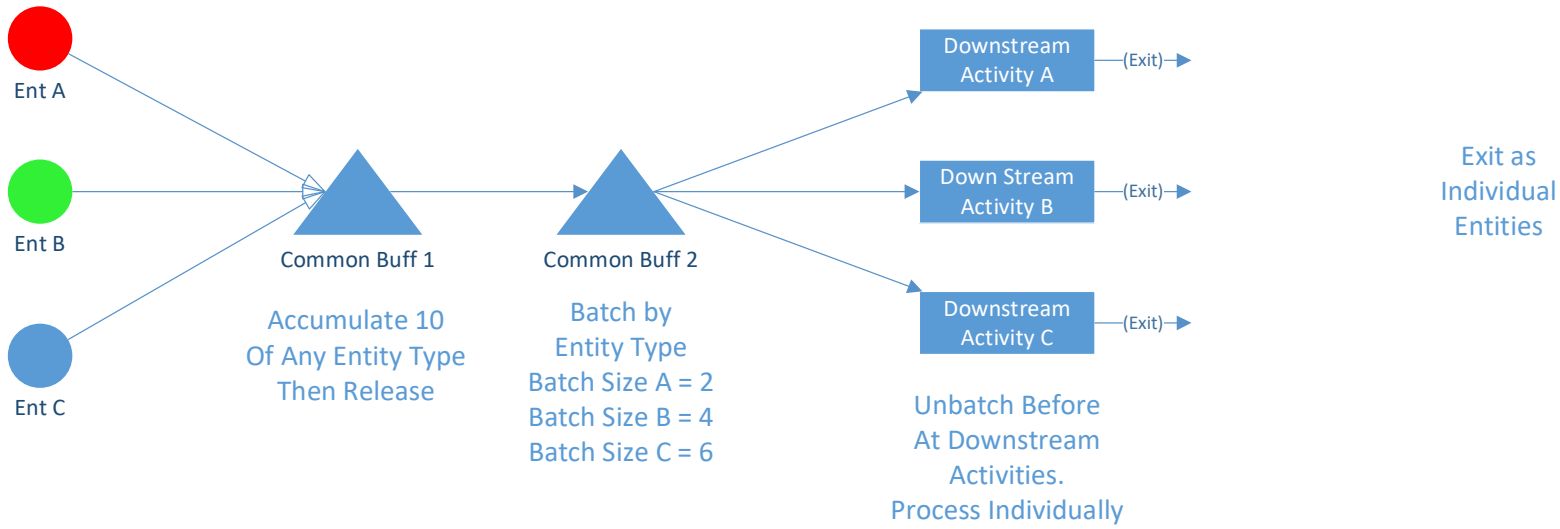
- Batching and Unbatching is normally done in the Input Buffers and/or Output Buffers of an Activity
  - Buffer capacity must be large enough for the Batch Size
    - Applies to both Batching and Unbatching, before or after an Activity.
- Batching can also be done in a Buffer element
  - More capability to control functionality over an Activity

# Default Batching and Unbatching Using Activities




**Model File:**
**Default Batching.pspkg**

# Batching and Unbatching Using Buffers provides more capability

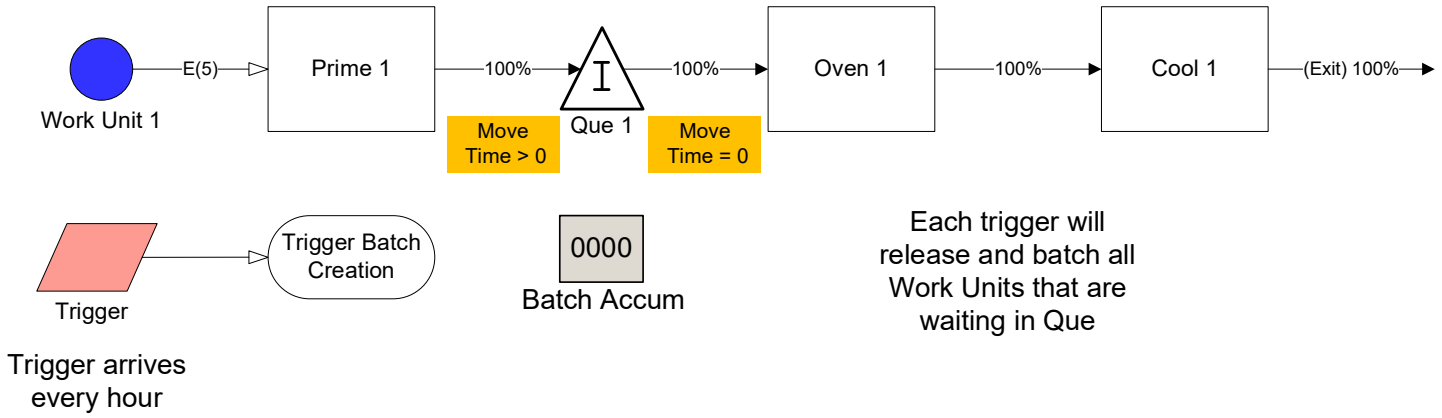


# Custom Batching

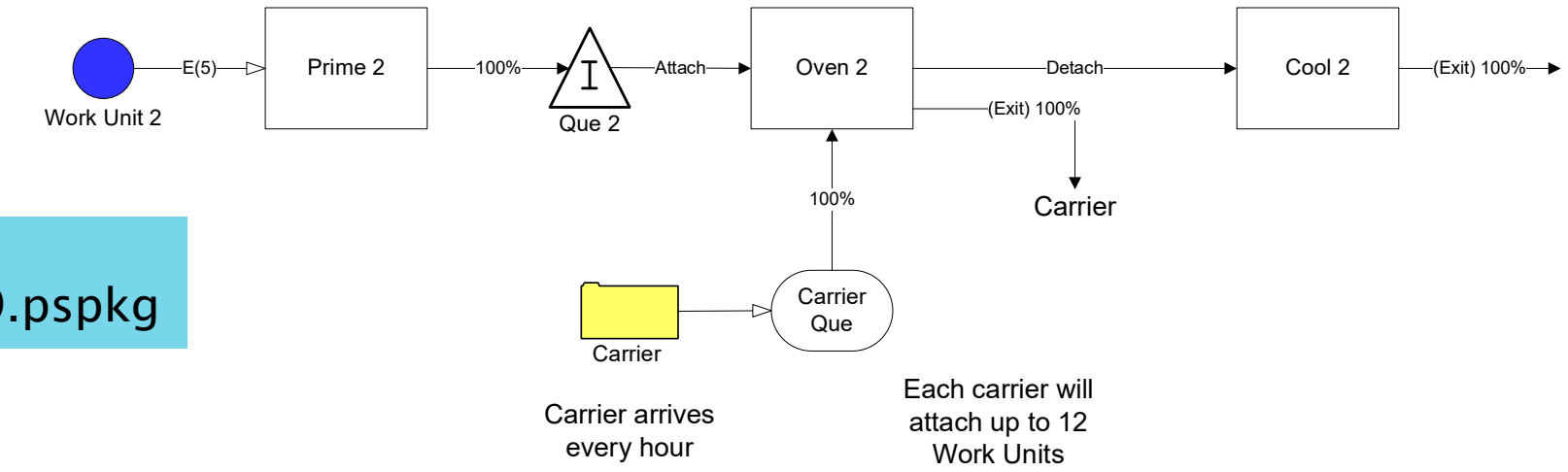
- 2 ways to Batch by Time instead of Quantity
  - Use a “carrier entity” to Attach & Detach the entities you want to be batched.
  - Use a Wait Until statement and Variables to control batching.

# Custom Batching Examples: Batch by Time

## Example 1: Using "Wait Until" Statement and Variables




## Example 2: Using "Attach & Detach" Routings and Carrier Entity




Model File:
Custom Batching Demo v2019.pspkg

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# FINISHED

- Thanks for attending this training course!  We hope it was helpful.
- Remember, help is only an email or phone call away.
- Good luck and happy modeling!

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