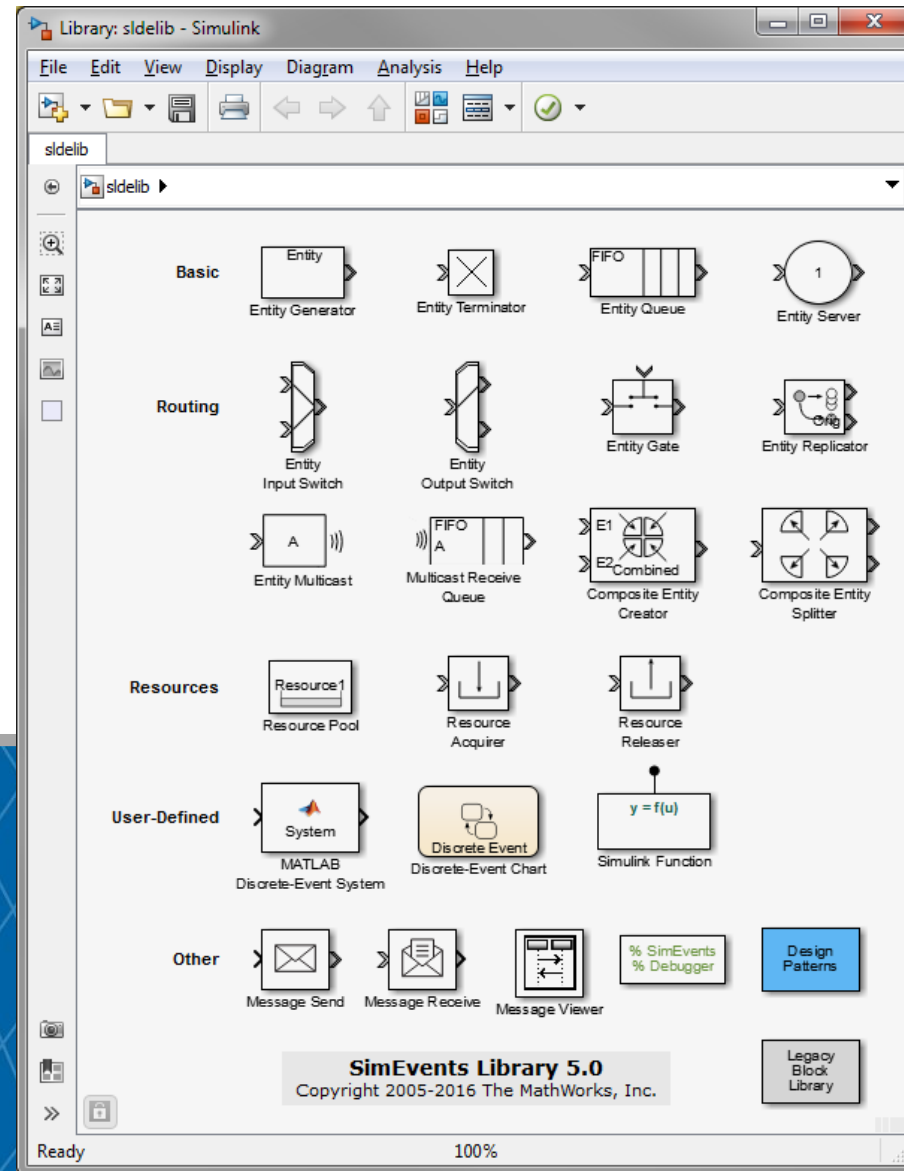# SimEvents
Hands-on Workshop

Housekeeping

- Please turn mobile phones to silent mode
- Feel free to take phone calls outside the room.
- Thank you!

SimEvents Workshop

- What is a workshop?
  - 2 - 3 hours of hands-on experience with SimEvents
  - Sufficient information *to get you started*

- What this is not
  - A formal training course in SimEvents

- Pre-requisites
  - Familiarity with using MATLAB

- Who will benefit?
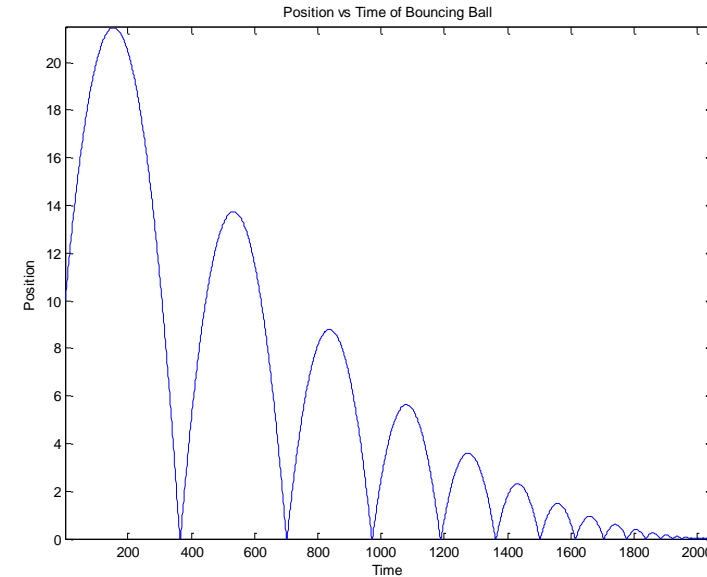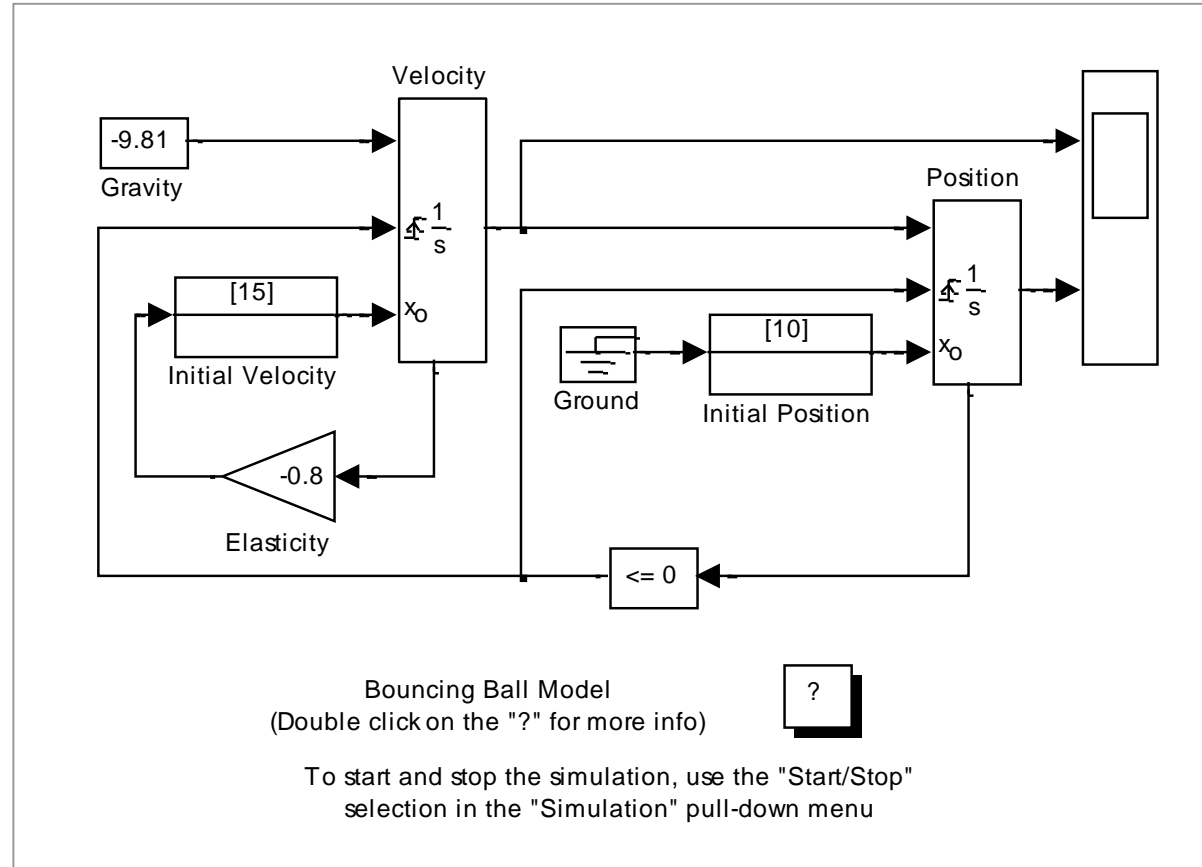 - Those who are interested in discrete event simulation

What you will learn:

- SimEvents is used to model the movement of some physical thing through a process. We call this physical thing an "entity".

- SimEvents is used to analyse, for example,
  - Resource contention
  - Congestion/bottlenecks/processing delays
  - Throughput
  - Scheduling and routing

- How to build a basic model using SimEvents blocks

What is SimEvents?

- SimEvents is an add-on to Simulink that provides Discrete Event Simulation capabilities on top of Simulink's time driven capabilities.

- A time driven system is solely based on time. As time moves forward, the state of the system can be accurately determined based on the current time and knowledge of the system dynamics.

- A discrete event system is driven by events that occur with some stochastic nature. It is typically a non-deterministic system.

Time-Based Systems

Velocity

-9.81
Gravity

$\frac{1}{s}$

x_0

[15]
Initial Velocity

-0.8
Elasticity

Position

Ground

[10]
Initial Position

$\frac{1}{s}$

x_0

<= 0

Bouncing Ball Model
(Double click on the "?" for more info)

?

To start and stop the simulation, use the "Start/Stop"
selection in the "Simulation" pull-down menu

Position vs Time of Bouncing Ball

Deterministic

Event-Driven Systems

State of the system (queue) does not change unless an **event** occurs.

Events:
- Someone joins the queue
- Someone gets served
- Someone leaves the queue

Non - Deterministic

Example
Tank Filling Station
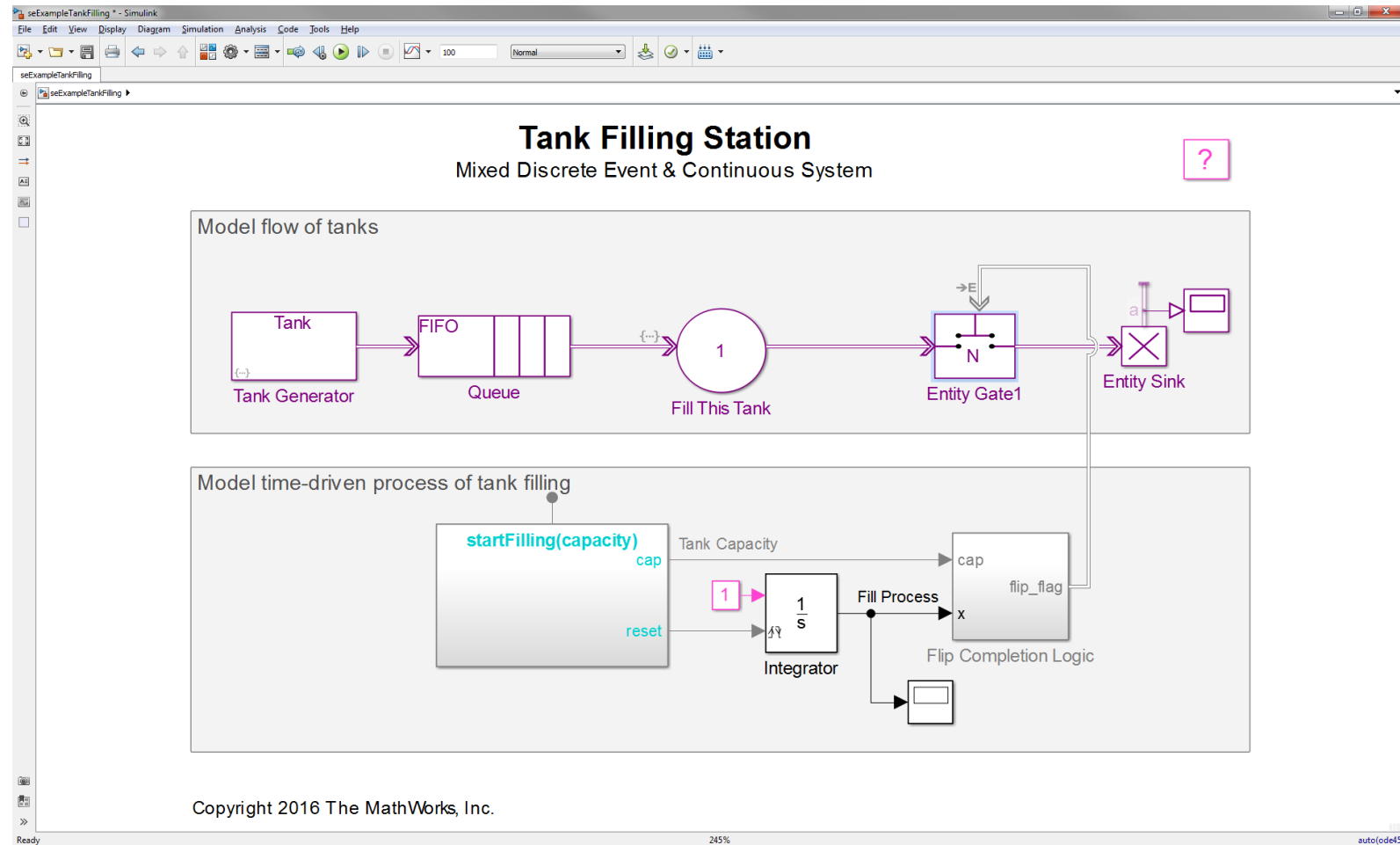
>>seExampleTankFilling

Examples of Systems Using SimEvents

Application	Entities Represent	Modeling
Processor	Instructions Interrupts Processes	Processing Times Throughput Latency
Communication Channel	Data Frames Video Packets Components of a protocol	Loading Congestion Data Loss Latency
Operators in a Call Processing Center	Calls	Loading Customer Hold times Number of operators needs
Tracking System	Objects Being Tracked Handoff Protocols between systems	changes when customers enter or leave store
Logistics and Operations (Aircraft Maintenance Station)	Aircraft	Aircraft Capability Available Number of maintenance stations required

Session 1: Instructor Lead

- Follow my lead
- We'll work through to exercise 3 together
- Feel free to ask questions along the way
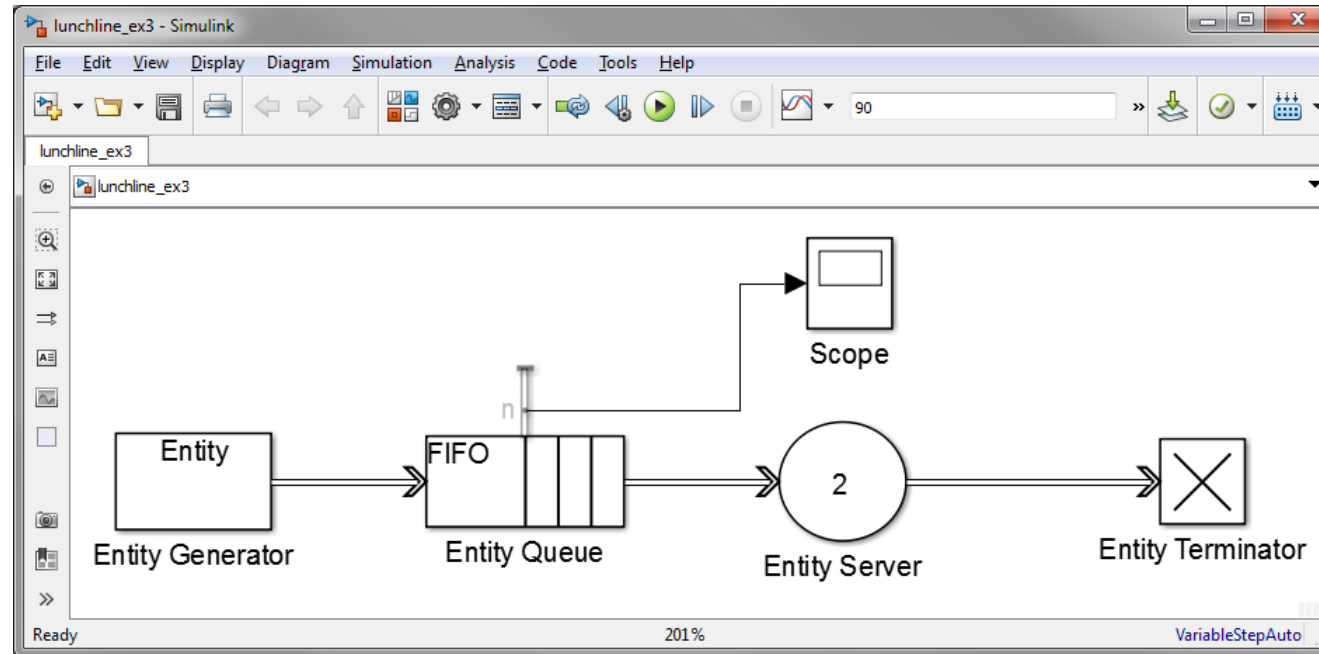
Session 2: Work on your own

- Follow the workbook instructions

- Feel free to ask questions along the way

- Some exercises have "Other Resources" for you to investigate further (now or later).

Exercise 4: Attributes and Blocking

TIP: You can open lunchline_ex3.slx if you wish to start from this exercise.

In this exercise you will define the non-deterministic length of time each entity spends in the server block, i.e., the length of time it takes to make the sandwich. It is possible to assign the time directly within the Entity Server block by changing the "Service time source" to "Signal port" or "MATLAB Action" from the drop down menu. In this exercise, however, you will define the time using an attribute. An "attribute" is simply numeric data that is attached to, and travels with, the entity.

Instructions:

1. Double click on the Entity Generator block and select the "Entity Type" tab. Make the changes as shown in Figure 11.
2. Now select the "Event actions" tab. Here you can define actions immediately after entities are generated, or immediately before entities exit the block. We want to define an action to generate a ServiceTime value after each entity is generated, so ensure that "Generate" is highlighted in the "Event Actions" window.
3. The action is expressed using MATLAB code. Attribute values can be accessed using dot notation. With this in mind, make the changes as shown in Figure 12.
4. Since we are defining the service time as an attribute, we now need to let the Entity Server block know to use this attribute. Double click on the Entity Server block, make the changes as shown in Figure 13
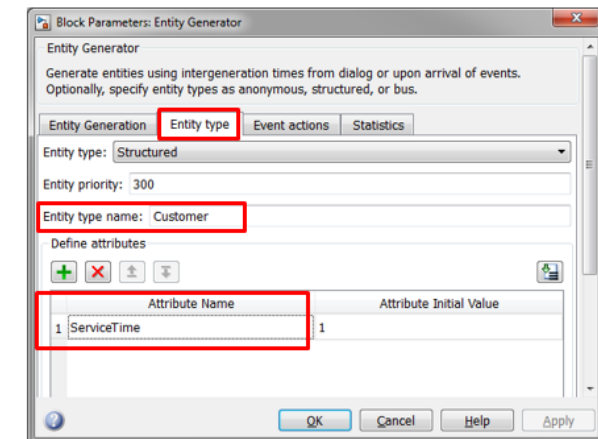5. Run the simulation and observe the results as shown in Figure 14.

Figure 11: Define the Entity Type and Attributes

Taking SimEvents Further

- Since SimEvents is built upon a MathWorks environment, you can leverage the power of MATLAB and Simulink to:
  - Drive simulations from MATLAB scripts to perform parameter sweeps and/or sensitivity analysis
  - Perform optimization and statistical analysis
  - Utilise parallel computing capabilities
  - Perform hybrid time-based and discrete event simulation
  - Visualize results of dynamic simulation

Further Information

- www.mathworks.com/products/
  - Simulink
  - SimEvents
  - Stateflow
  - Statistics Toolbox
  - Optimisation Toolbox
  - Global Optimisation Toolbox

- Contact us
  - Email: info@mathworks.com.au
  - Phone: 02 8669 4700