DESMOD: A PYTHON BASED MODELING ENVIRONMENT

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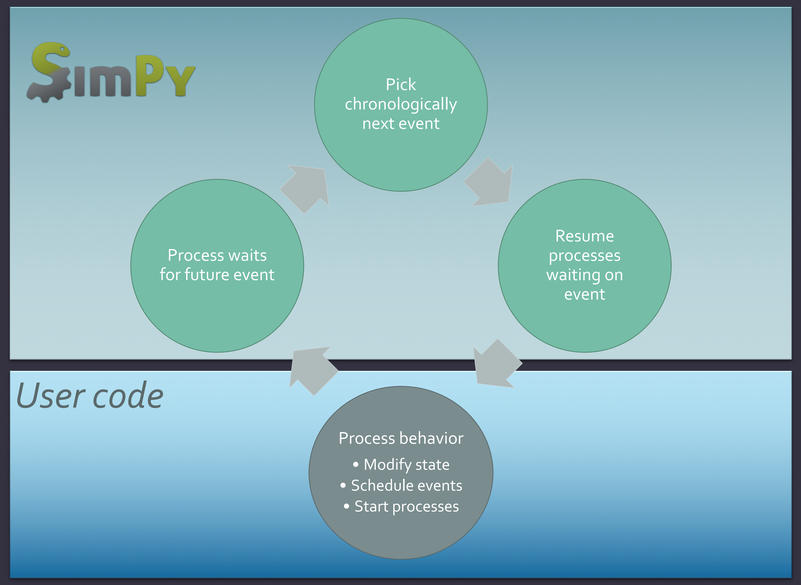
What is discrete event simulation?

- Simulate dynamic behavior of system of parallel processes
  - Progression of time is simulated
- Events are scheduled to happen at specific times
  - Simulated behavior happens in response to events
  - Simulation state is static between events
  - Simulated time moves forward in discrete steps
- Parallel processes are simulated
  - One or more parallel processes
  - Events wake processes
  - Processes may schedule events
  - Processes may start more processes

Discrete	Event	Simulation	Modeling
Time steps forward in discrete increments…	in response to scheduled events…	to simulate the dynamic behavior of…	the modeled system.



Why model?

- Predict system dynamics in advance
- Explore alternative behaviors
- Less expensive than building full system
- Modeling is fun!

Applications

- Networking
- Data flow
- Queueing systems
- Plant systems

About Desmod

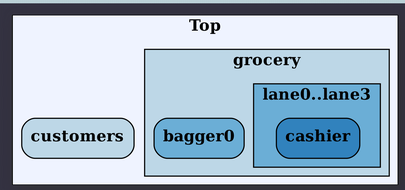
- Open source project originating at SanDisk (now Western Digital)
- Based on the SimPy discrete event simulation kernel
- Includes "batteries" every model needs:
  - Hierarchical organization
  - Init, elaboration, simulation, and post-simulation phases
  - Model configuration
  - Multi-factor experiments
  - Result artifacts
  - Command line interface toolkit
- Tools for observing model behavior:
  - Auto-generated model diagrams using DOT
  - VCD output for time-series view of system state
  - Capture data in SQLite
  - Standardized text logging

Checkout Desmod

- https://pypi.python.org/pypi/desmod
- http://desmod.readthedocs.io/

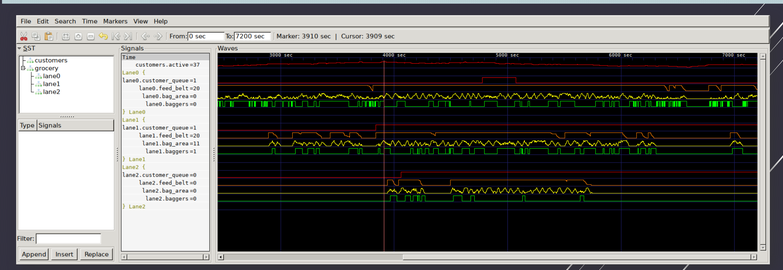
Example: Grocery Store Checkout

- Models grocery store with multiple checkout lanes
  - Each checkout lane has a cashier
  - Baggers are dynamically assigned based on configurable policy
- Measure customer checkout time and throughput
- Optimize policies and resources



Value Change Dump

- Visualize checkout lane state changes
- View with GTKWave
- May be viewed in realtime while simulation is running



Multi-factor Experiment

- Four configuration factors:
  - Lanes, bagging rate, bagger assignment policy, and PRNG seed
  - Chart shows results from 900 simulations
- Customer throughput is measured
  - Find inflection points by visualizing with Seaborn