Demand Simulator

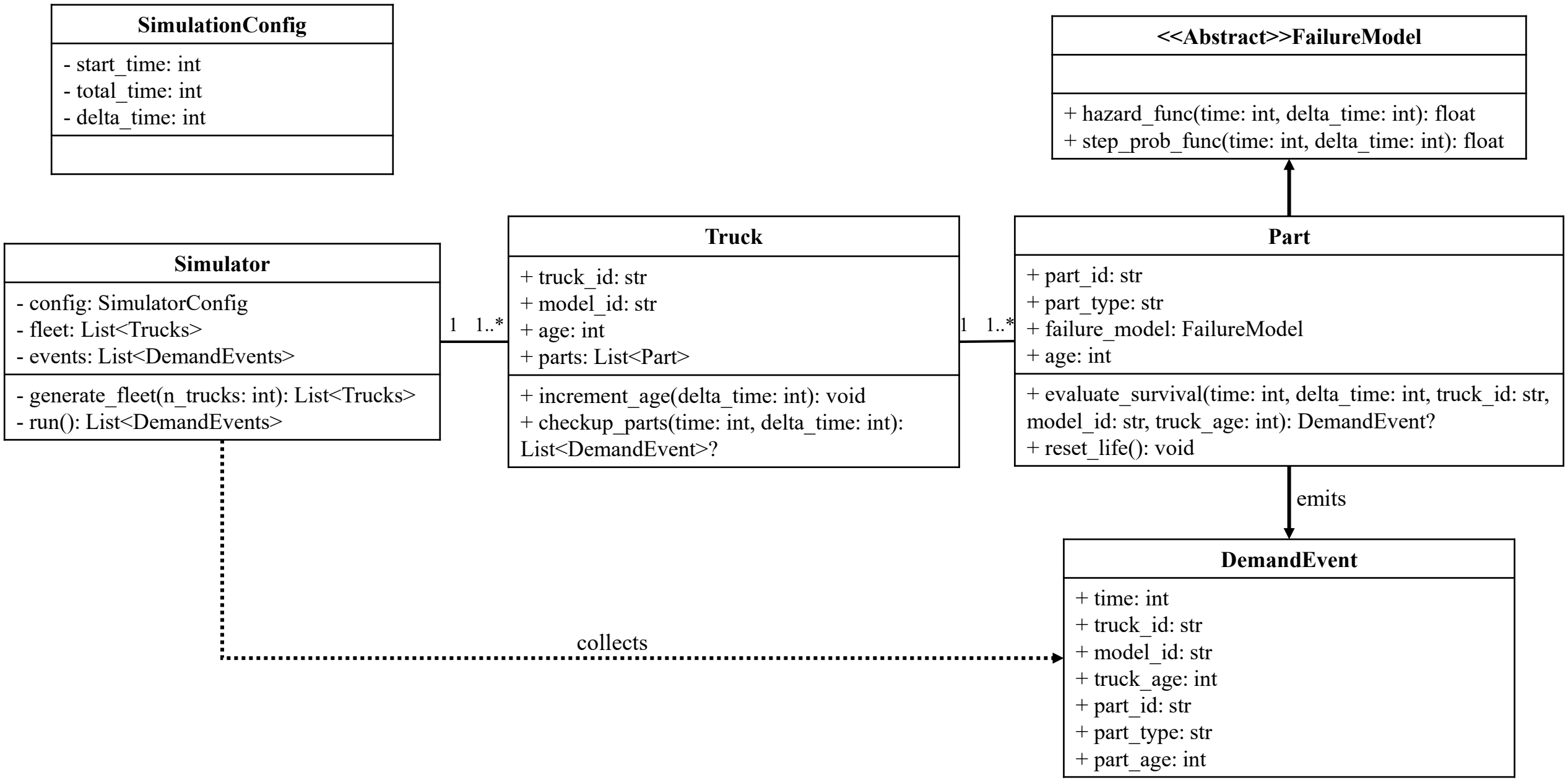
2025-10-02

Overview

Development of spare parts demand simulator

- Simulation framework generates **synthetic spare parts demand** for a population of trucks by employing **survival models** with time-varying usage states and operating conditions.
- **The simple simulator:**
  - Advance in daily steps for 365 days.
  - Use **exponential distribution** as the survival model.
  - Define **10 trucks** and attach **4 types of parts**.
    - 10 Tires, 2 brake pads, 1 oil filter and 1 battery
    - Allocate distinct MTTF for each part.
  - operating conditions (usage pattern, terrain, …) are **not yet considered**.
  - Failures are logged as **demand events** for forecasting and inventory-policy evaluation.

class diagram



Pseudo Code

```
# 1. Initialization
Instantiate Truck() objects.
Instantiate Simulation() object.
Attach Part() objects to each truck.
time ← 0

# 2. Time loop
while time < T
    for each truck_j in trucks do
        for each part_k in truck_j.parts do
            # evaluate part k survival
            event ← part_k.evaluate_survival()

            # if failure
            if event != None
                simulation.record(event)       # log
                part_k.reset_age()

            part_k.age ← part_k.age + 1
        truck_j.age ← truck_j + 1
    time ← time + 1

# 3. Output: spare parts demand data (time series data)
```