The Reaction Vessel Overview

Ben E. Cline

braininfo **at** benjysbrain.com

What Is the Reaction Vessel

- A Java programming framework
- Provides a novel approach to problem solving based on the chemical metaphor
- Provides automatic concurrency at the thread level
- Helps the programmer expose data dependences
- Provides a degree of fault tolerance

The Chemical Metaphor

- The chemical metaphor means some aspect of a computational system is analogous to the way real chemicals interact
- In the Reaction Vessel, program segments and data objects are treated as colliding molecules interacting in a virtual reaction vessel

Reaction Vessel Objects

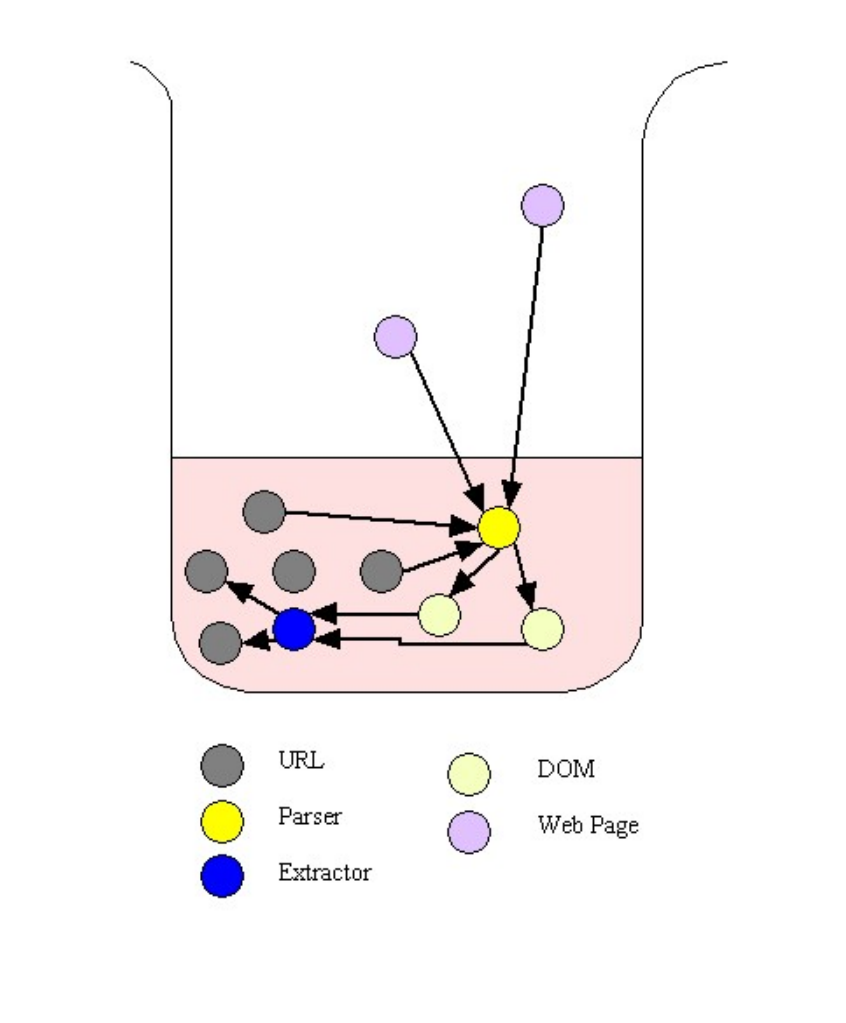
- ReactionVessel – the virtual reaction vessel
- ProgramMolecule – Superclass of program molecules
- DataMolecule – Superclass of data molecules
- The virtual reaction vessel causes program and data molecules to interact in a concurrent manner by simulating molecular collisions

Example

A simple web crawler is decomposed into parser and extractor program molecules.

URLs and DOMs (parsed pages) are contained in data molecules.

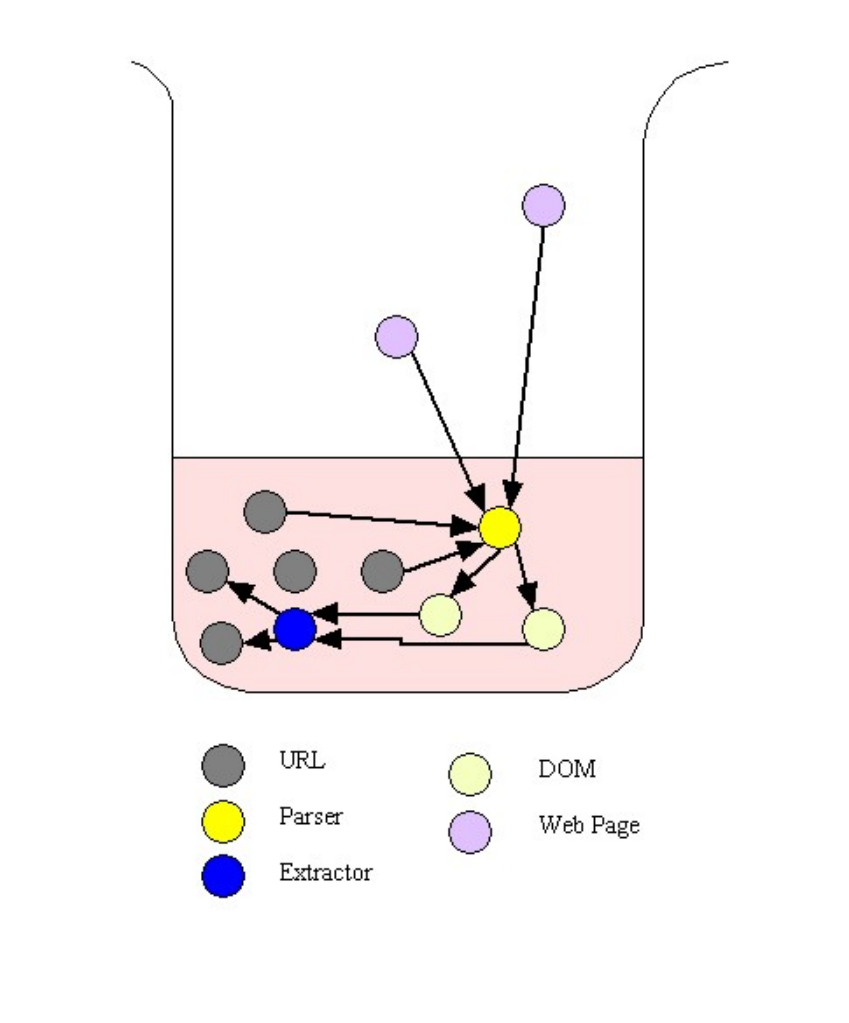
Web pages can be viewed as external data molecules.



Example

The programmer thinks in terms of program molecules attaching to and processing data molecules. He designs (1) a web page parser program molecule and (2) an extractor program molecule that extracts URLs from parsed pages using XPath or other technology.

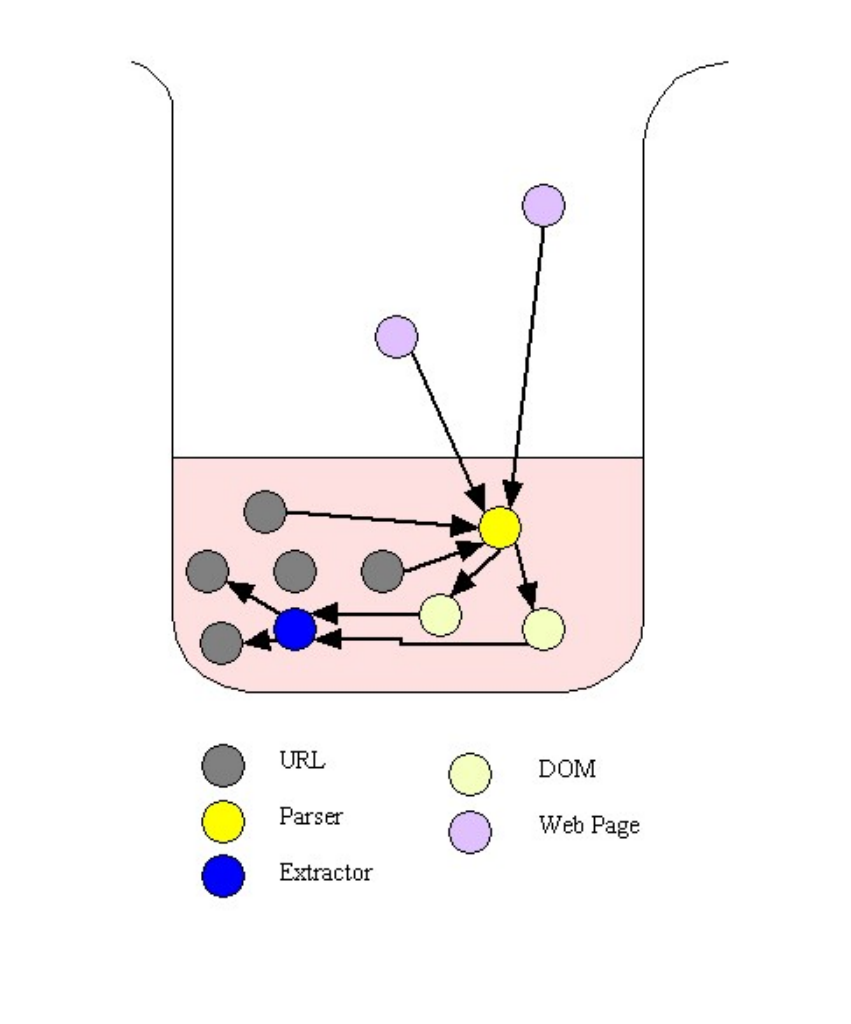
The extracted URLs are placed in data molecules that will eventually be processed by the parser.



Example

The Reaction Vessel handles concurrency. The parser and extractor can be operating on multiple data items concurrently in different threads.

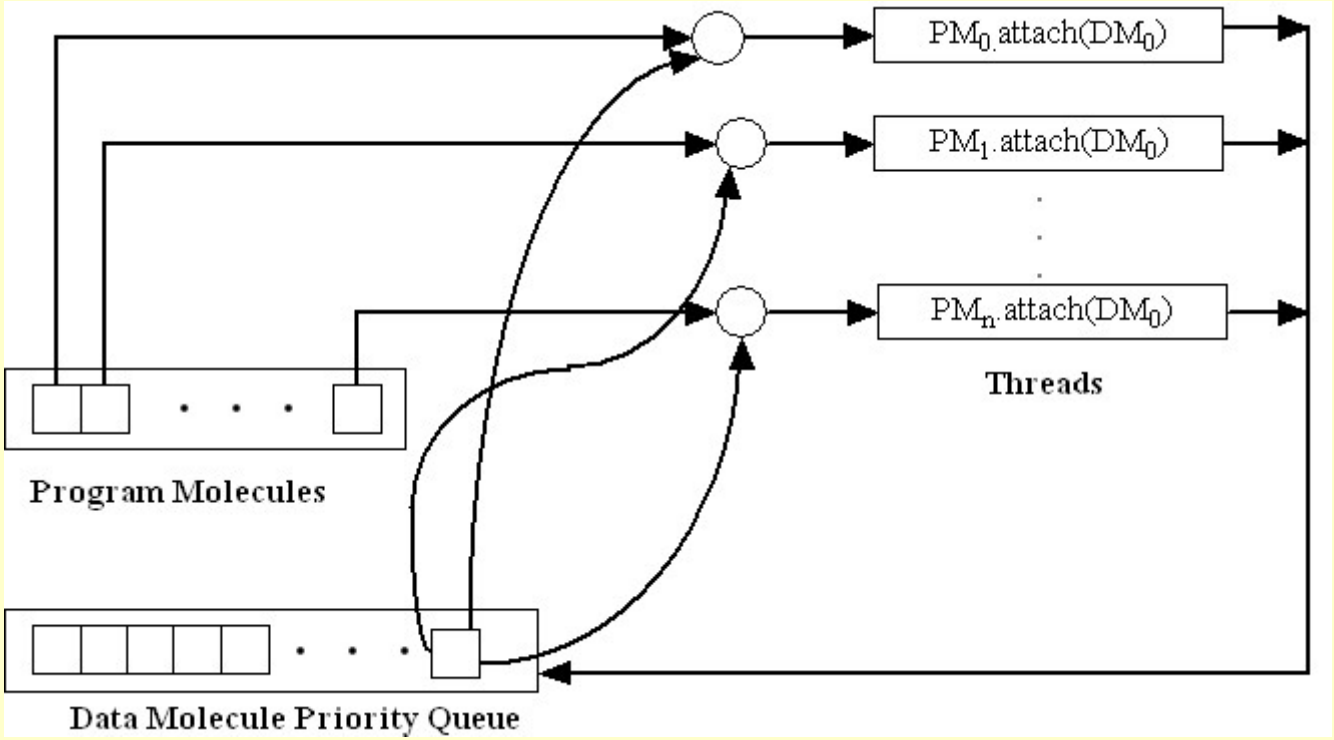
The programmer has to design the program and data molecules so that data dependences are explicit. The parser only handles URL data molecules; the extractor only handles DOM data molecules.



Reaction Vessel Collisions

- During each step of the Reaction Vessel, a data molecule is collided with zero or more program molecules:
  - Select the highest priority data molecule DM_j
  - For each compatible program molecule PM_i, run PM_i.attach(DM_j) in a new thread
  - Discard DM_j
  - Add any new data molecules created by the collisions to the virtual reaction vessel

Reaction Vessel Architecture



Benefits

- The programmer does not have to handle thread operations
- Provides a different way to think of problem decomposition
- Provides a degree of fault tolerance
- Helps the programmer think about data dependences

The Reaction Vessel

- Paper: "The Reaction Vessel: A General-Purpose Programming Framework Based on the Chemical Metaphor" (http://www.benjysbrain.com/setp103ISRST.pdf)
- Web site: http://www.benjysbrain.com/rvtease.html