LARA Tutorial

4. Weaving MATLAB

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ANTAREX 10^{18}

SPeCS Special-Purpose Computing Systems, languages and tools

Objectives

- Introduction to MATISSE

- Using LARA to analyse and modify MATLAB programs

What is MATISSE?

- MATISSE: Framework to analyse and compile MATLAB code;
  - MATLAB: High-level programming language based on matrices
  - Used in scientific, engineering and finance domains.
- MATISSE has two main features:
  - MATLAB Weaver: LARA for MATLAB
  - Compilation to C and OpenCL code
- We'll focus on LARA for now

LARA for MATLAB

- We can apply LARA aspects to MATLAB files.
- All we have to do is switch weavers
- Note that MATLAB and C are different, so the joinpoints sometimes differ.

http://specs.fe.up.pt/tools/matisse/

4.1 Target Language Report

- Goal: Report information regarding the target language
  - Join point: points of interest in the code
  - Attribute: information concerning a join point
  - Action: target code transformation

- Strategy
  - Use *Weaver* object
  - Show available join points and root
  - Iterate join points
    - List attributes, selects and actions

Weaver object members:

```
Weaver.root
      .joinpoints
      .selectsOf( jpName )
      .actionsOf( jpName )
      .attributesOf( jpName )
```

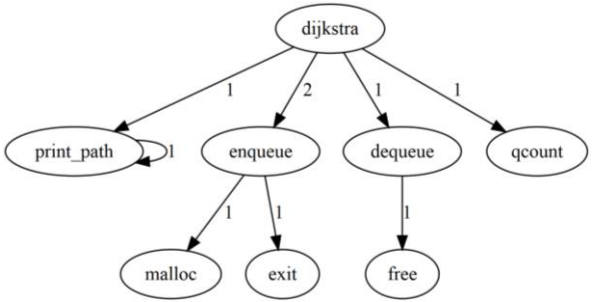
4.2 Static Call Graph

- Goal: Print a static call graph in dot format
- Identical to the MANET version
- File:
  - Any
- Strategy
  - Select pairs function->call
  - Count occurences of each pair
  - Iterate LaraObject and print

Example dot and resulting graph:

```
digraph static_call_graph {

            print_path->print_path [label="1"];
            enqueue->malloc [label="1"];
            enqueue->exit [label="1"];
            dequeue->free [label="1"];
            dijkstra->enqueue [label="2"];
            dijkstra->qcount [label="1"];
            dijkstra->dequeue [label="1"];
            dijkstra->print_path [label="1"];
}
```



4.3 Parfor To For

- Goal:
  - Identify Parfor loops and convert them to sequential for loops
- File:
  - subband.m (Modified)
- Strategy
  - Find all parfor loops
  - Replace the “header” of the loop with the “for” equivalent.

4.4 Validate Naming Conventions

- Goal:
  - Find violations of naming conventions
- File:
  - test.m
- Strategy
  - Find functions or variables
  - Check if their name follows the naming conventions

4.5 Find Common Typos

- Goal:
  - Find typos in code bases (e.g. “retrun” instead of “return”)
- File:
  - typo.m
- Strategy
  - Find implicit or script calls
  - See if their name is on a list of “common typos”.

4.6 Detect Missing Preallocations

- Goal:
  - Detect inefficient MATLAB idiom where matrices are resized in loops
- File:
  - latnrm.m
- Strategy
  - Find variables that are properly initialized
  - Find array sets in loops
    - See if they were properly initialized
    - Complain if they were not

Takeaway Points

- MATISSE: Framework to analyse, modify and compile MATLAB
- LARA can handle multiple languages
- We can use LARA to detect certain idioms