Lab: Information Flow Tracking

(Week 3)

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Quiz-1 + Lab-Exercise-1 + Assignment-1

- A set of quizzes on WebCMS (5 points)
  - LLVM compiler and its intermediate representation
  - Code graphs (including ICFG and PAG)
- Lab-Exercise-1 (5 points)
  - Implement a graph traversal on a general graph
- Assignment-1 (20 points)
  - **Control-flow**: Implement a context-sensitive graph traversal on a CodeGraph (i.e., ICFG) and print **feasible** paths from a source node to a sink node on the graph
  - **Data-flow**: Implement Andersen's inclusion-based constraint solving for points-to analysis
  - Implement a taint checker using control-flow analysis and data-flow analysis.

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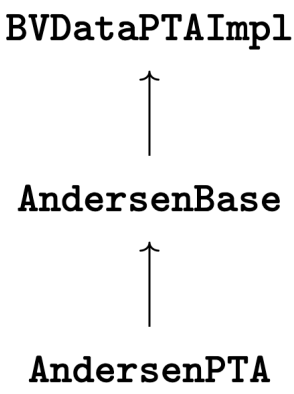
  - **Specification and code template**: `https://github.com/SVF-tools/Software-Security-Analysis/wiki/Assignment-1`
  - **SVF APIs for control- and data-flow analysis** `https://github.com/SVF-tools/Software-Security-Analysis/wiki/SVF-CPP-API`

Assignment Structure



- You will be working on `AndersenPTA`'s `solveWorklist` method.

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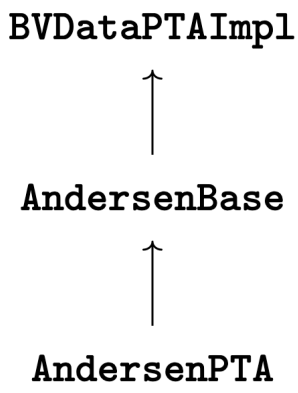

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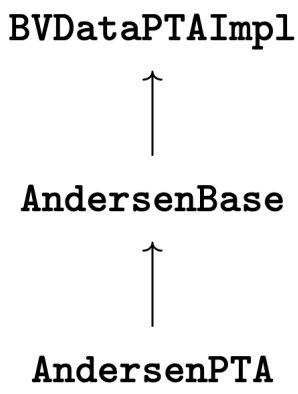

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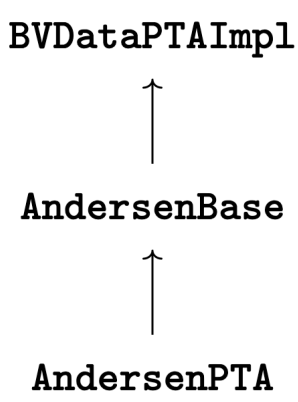
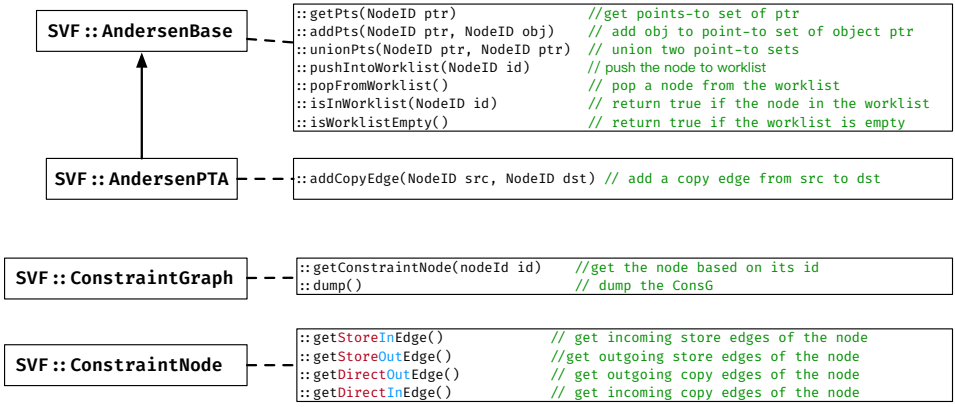


- You will be working on `AndersenPTA`'s `solveWorklist` method.
- Constraint graph is the field `consCG`.
- Address edge processing is done for you.
- Note in the API there is a `getDirectInEdges`/`getDirectOutEdges` but no `getCopyIn/OutEdges`. This is intentional, use the `Direct` variant.
- You will reuse this assignment for assignment 4, make sure it is clean. :)

APIs for Implementing Andersen's analysis



https://github.com/SVF-tools/Software-Security-Analysis/wiki/SVF-CPP-API#worklist-operations
https://github.com/SVF-tools/Software-Security-Analysis/wiki/SVF-CPP-API#points-to-set-operations
https://github.com/SVF-tools/Software-Security-Analysis/wiki/SVF-CPP-API#alias-relations
https://github.com/SVF-tools/Software-Security-Analysis/wiki/SVF-CPP-API#constraintgraph-constraintnode-and-constraintedge

Assignment 1: Taint Tracker

- Implement method `readSrcSnkFromFile` in `Assignment-4.cpp` using C++ file reading to configure sources and sinks.
- Implement method `printICFGPath` to collect the tainted ICFG paths and add each path (a sequence of node IDs) as a string into `std::set<std::string> paths` similar to Assignment 2
- Implement method `aliasCheck` to check aliases of the variables at source and sink.

Coding Task

- Code template and specification: `https://github.com/SVF-tools/Teaching-Software-Analysis/wiki/Assignment-4`
- Make sure your previous implementations in `Assignment-2.cpp` and `Assignment-3.cpp` are in place.
  - Class `TaintGraphTraversal` in Assignment 4 is a **child class** of 'ICFGTraversal'. `TaintGraphTraversal` will use the `DFS` method implemented in Assignment 2 for **control-flow traversal**.
  - Andersen's analysis implemented in Assignment 3 will also be used for **checking aliases** between two pointers.

C++ File Reading

Implement method `readSrcSnkFormFile` in `Assignment-4.cpp` to parse the two lines from `SrcSnk.txt` in the form of

```
source -> { source src set getname update getchar tgetstr }
sink -> { sink mysql_query system require chmod broadcast }
```

Please refer to the following links (among many others) for C++ file reading:

- https://www.tutorialspoint.com/cplusplus/cpp_files_streams.htm
- https://www.cplusplus.com/doc/tutorial/files/
- https://linuxhint.com/cplusplus_read_write/
- https://opensource.com/article/21/3/ccc-input-output