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Frappé: A Code Comprehension Tool for Large Codebases

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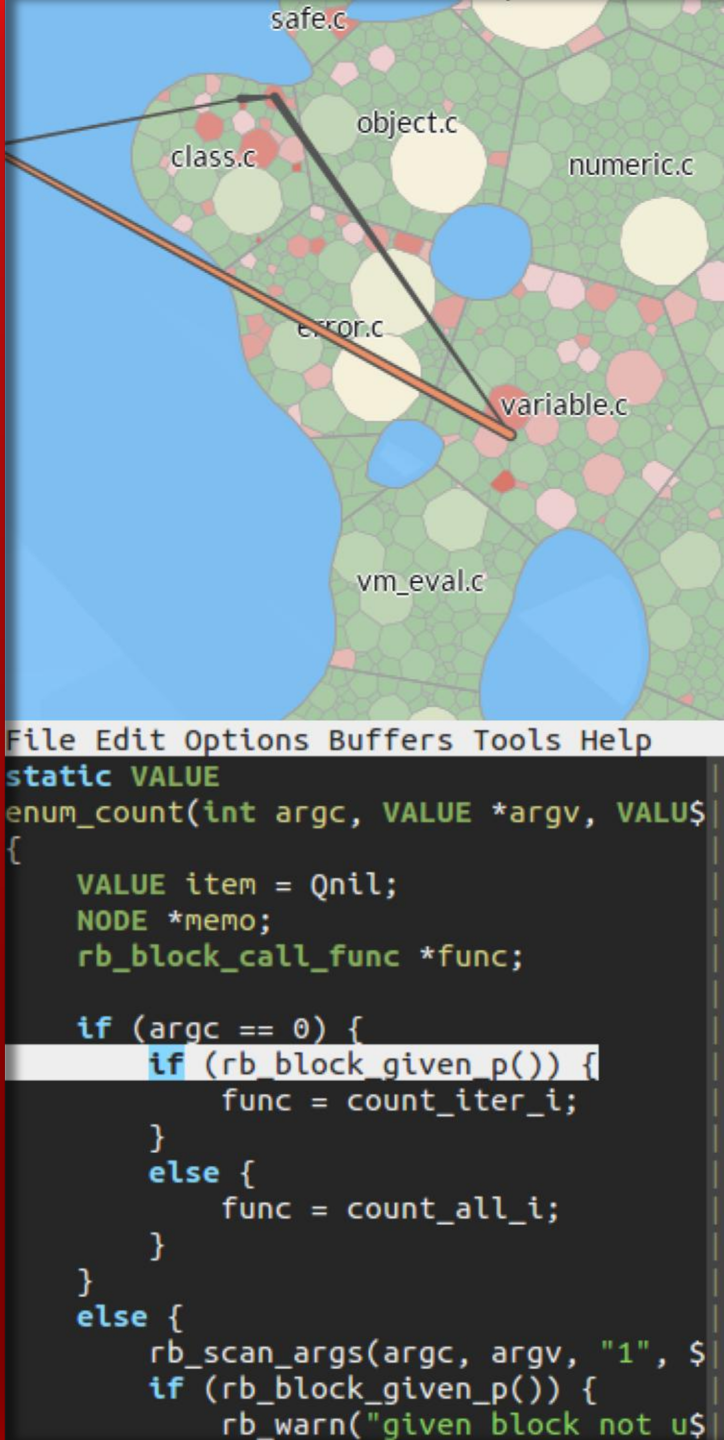
April 2014



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Program Agenda

- Background
- The Frappé Tool
- Demonstration
- Future Work

Code Comprehension

- Code comprehension is an integral part of a programmer's every day tasks
- Modern IDEs provide many features to facilitate this
  - Go to definition/implementation, find usages, class overview, etc.
- Unfortunately, using IDEs is often impractical for many large C/C++ codebases
  - Difficult to integrate with custom build systems
  - Often use custom parsers that lag behind real compilers and can be imprecise
  - Excessive startup time and memory usage

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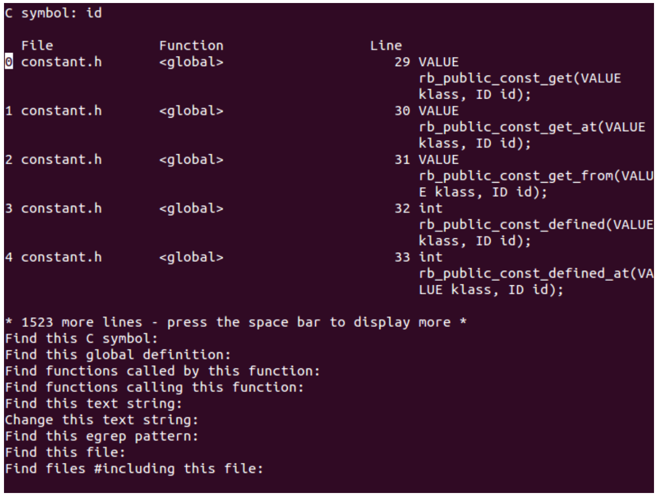
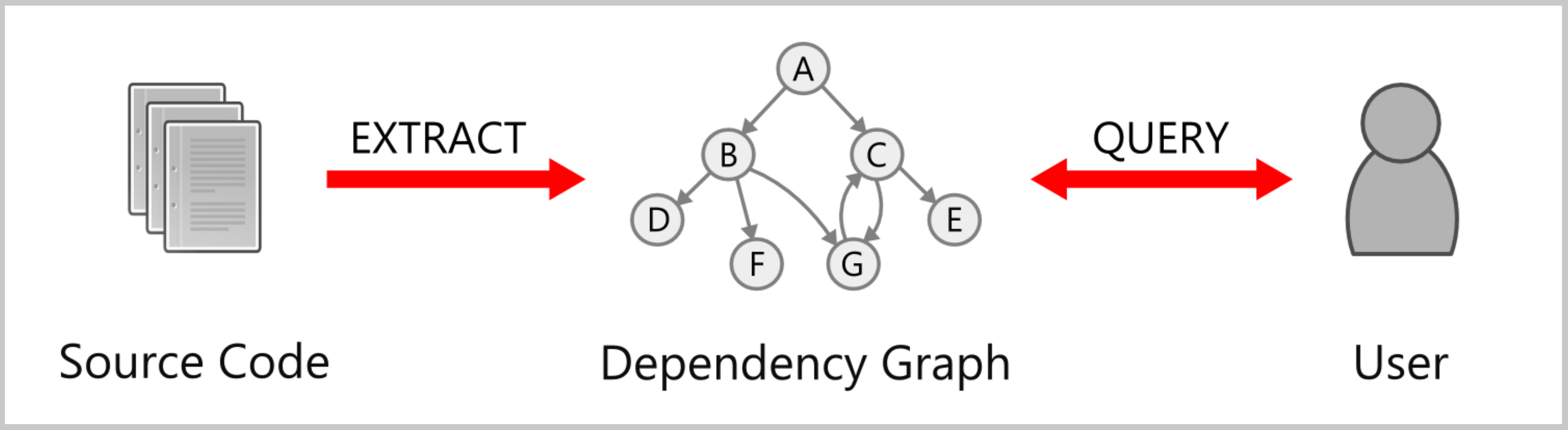
Current Tools

- Lightweight text editors
  - Regex based tools for lookup (Grep, CScope, etc.)
- Fast and easy to integrate but imprecise:
  - Largely unaware of symbol types, scopes, linking information, and the preprocessor
  - Deal only with direct dependencies
- Our goal: address these limitations and maintain comparable scalability and ease of integration



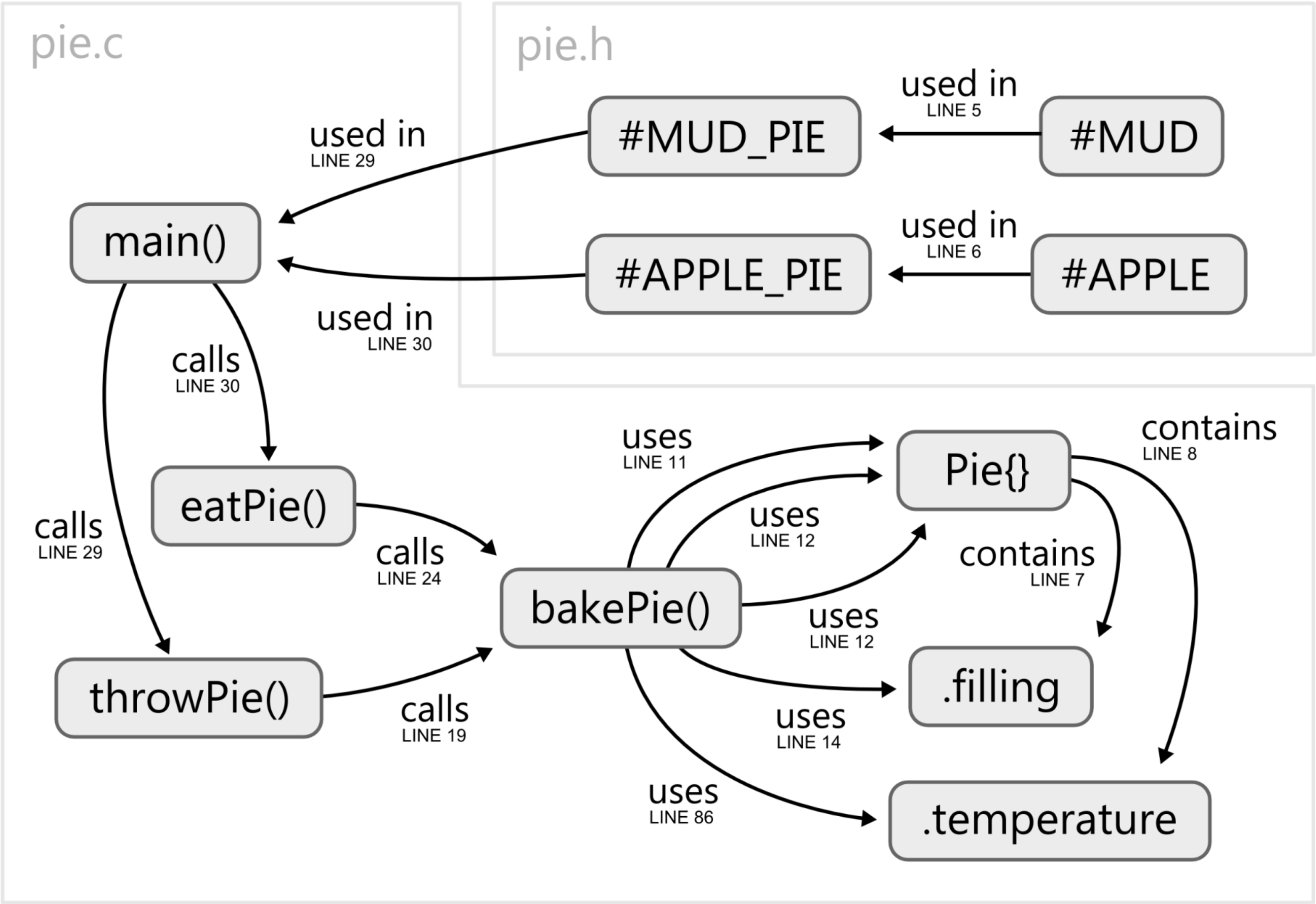
Our Approach



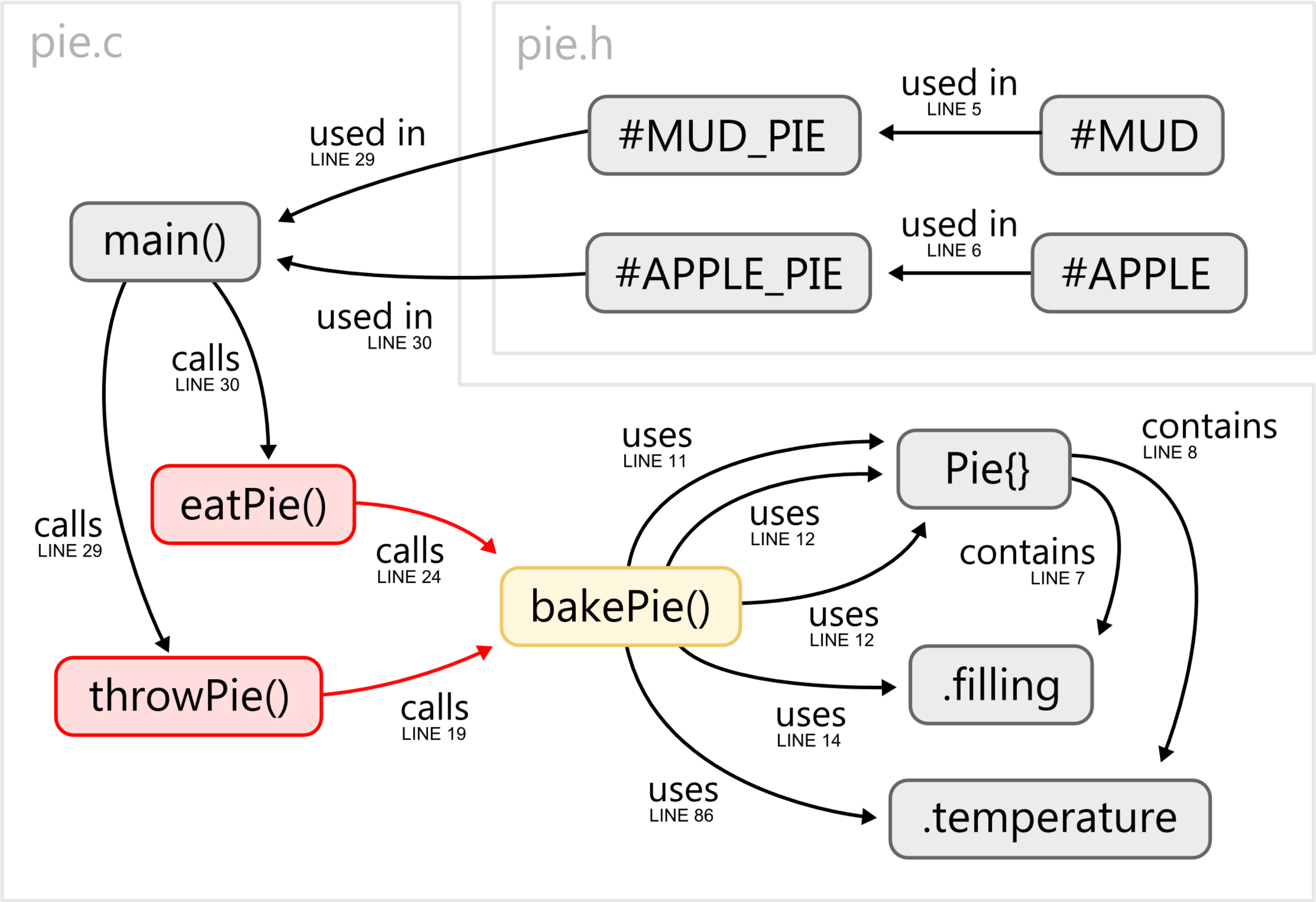
- Extract dependency graph of codebase
  - Nodes are entities within the code (functions, macros, etc.)
  - Edges are dependencies between those entities (calls, uses, etc.)

- Can express code comprehension queries as graph matches

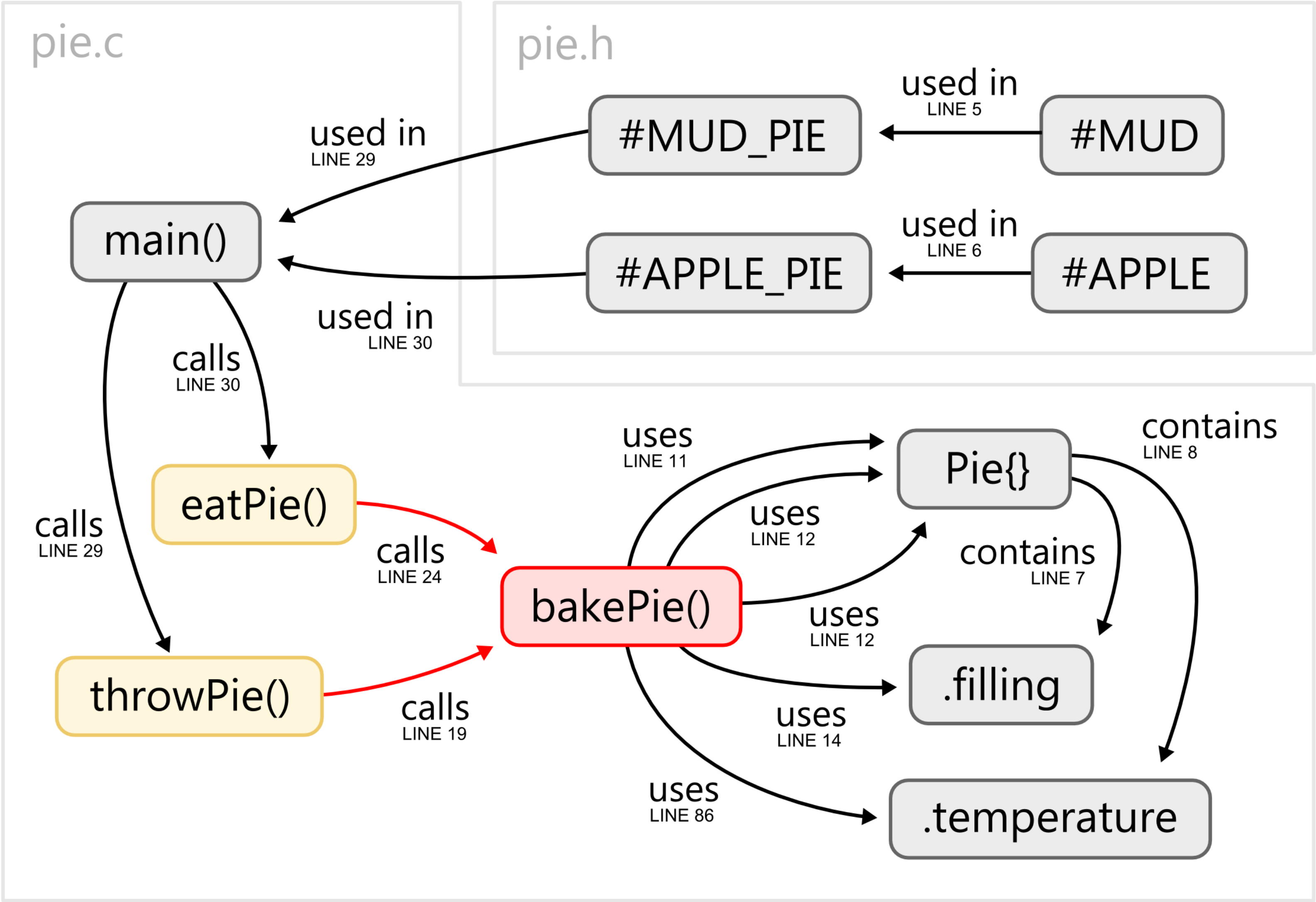
Graph Matching



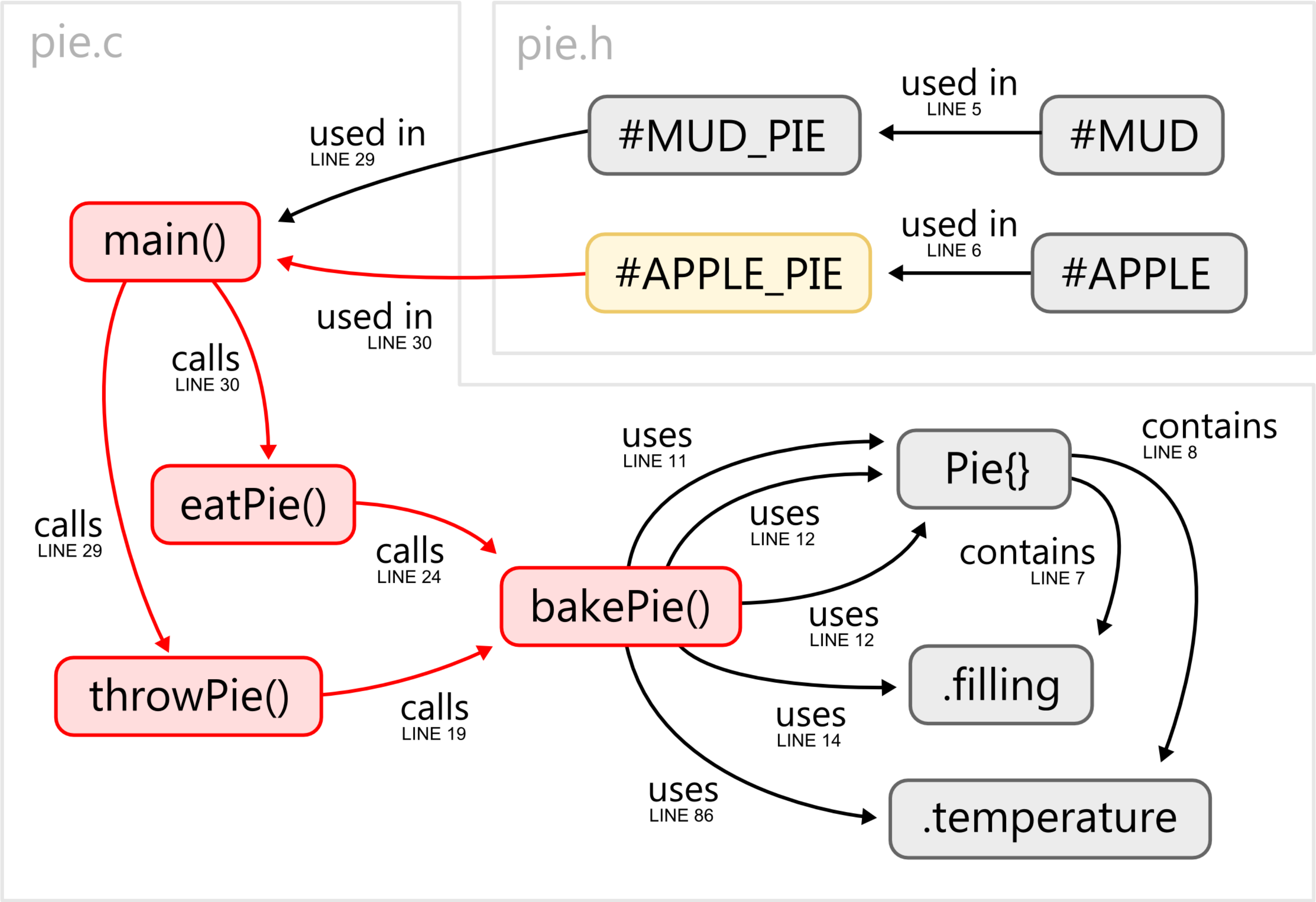
Find References



Go to Definition

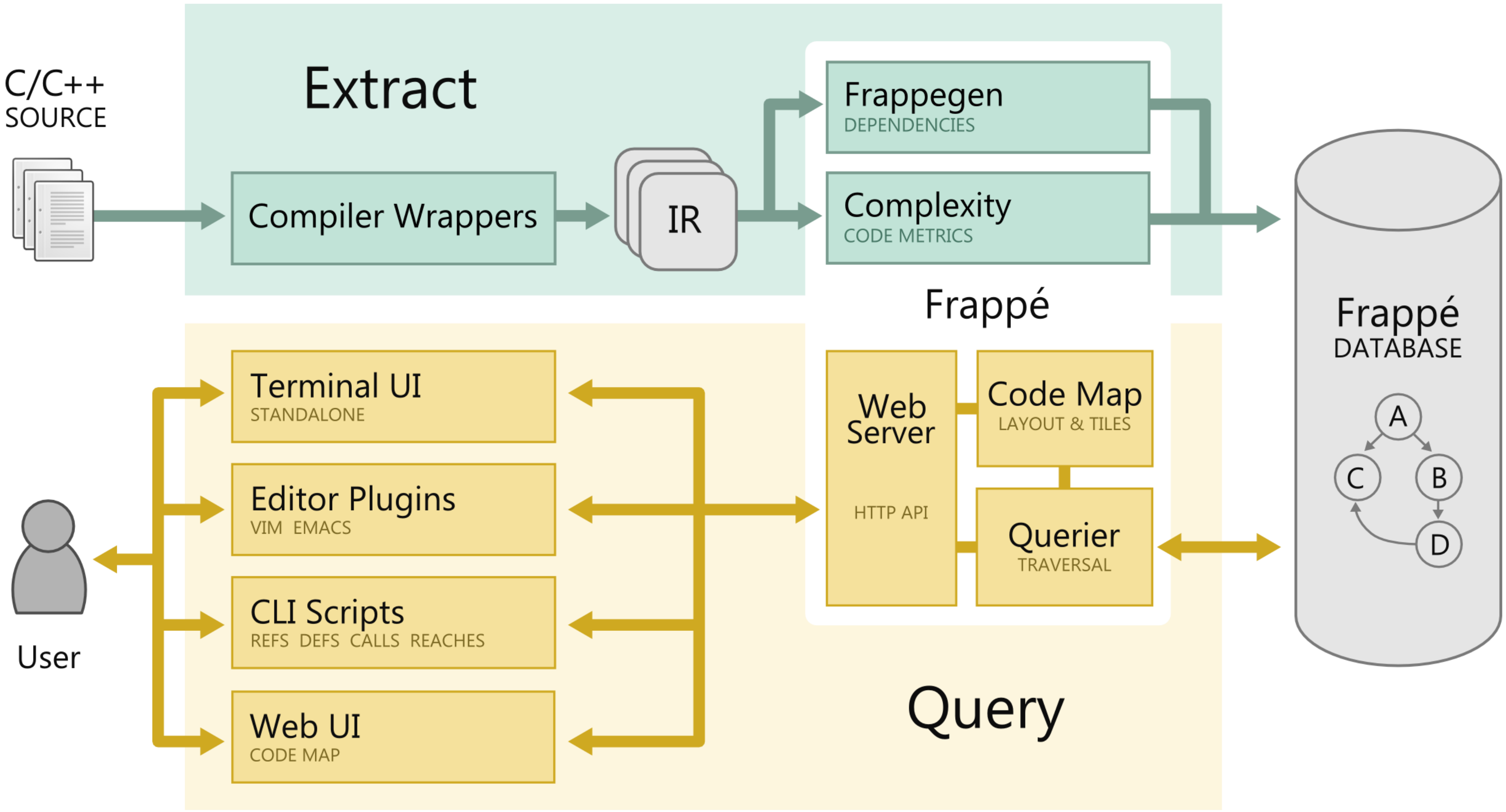


Impact Estimation



Frappé

A Code Comprehension Tool for Large Codebases



Current Performance

C Codebase - About 10 MLOC

Step	Time	Peak Memory
Extract dependencies (4 jobs)	2.5 hours	1 GB
Generate code map	1.5 hours	15GB
Search for specific function	<1s	< 1GB
Compute impact set (15 jumps)	<1s	< 1GB
Compute reachability (15 jumps)	<1s	< 1GB

Improving Extraction Time

Solutions being investigated

- Build complete graph in nightly, then either:
- Pull down graph database and maintain locally
  - Database size has to be reasonable
- Create local graph of only modified files
  - Database size doesn't matter
  - Queries potentially slower (network latency)
  - Division between central and local databases makes transitive queries difficult
- Or, don't worry about local changes

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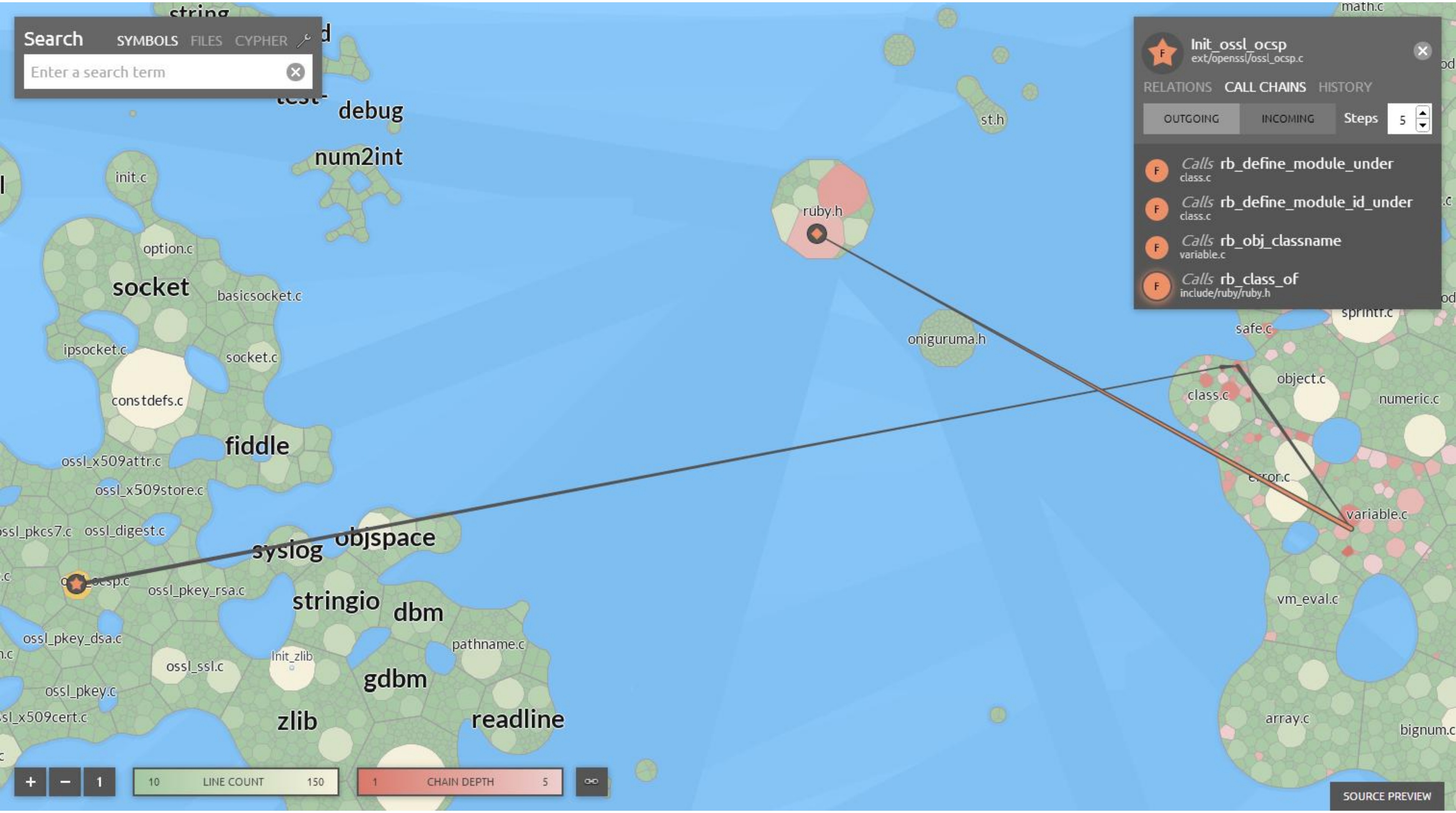
Demonstration

Emacs, CLI Scripts, and Web UI



Going Forward

- Reduce initial graph extraction time
- Produce more precise graph
  - Pointer analysis (calls via function pointers, virtual calls, etc)
  - Template handling
- Filter on dynamic information
  - Show the commonly used paths
- Java support
  - Cross language (JNI)

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Hardware and Software

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