Session 3

High level dynamic analysis views

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Combining Reverse Engineering Techniques for Product Lines

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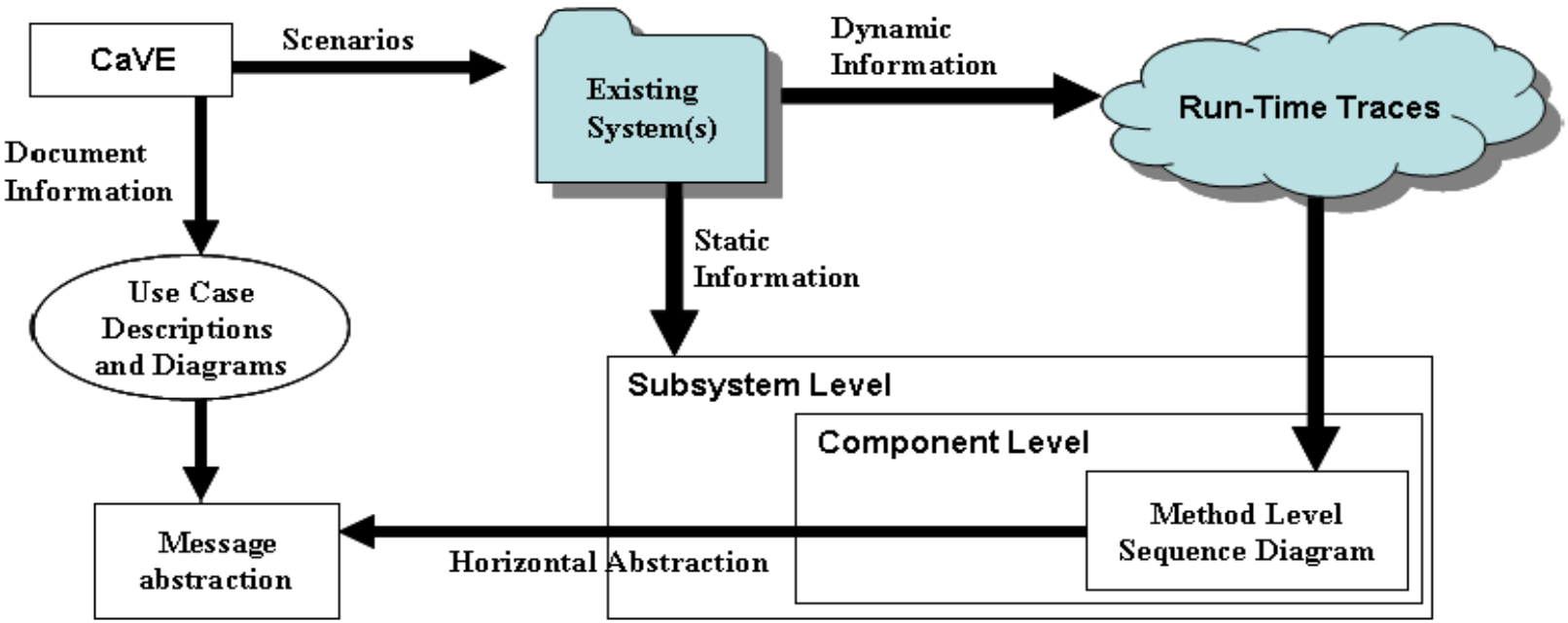
Motivation

- Migration towards product lines
  - “Recover and reconstruct” strategy
- Approach
  - Identify and prioritize relevant assets
  - Combine reverse engineering techniques to recover these assets
  - Visualization
    - Hierarchical graphs
    - Message sequence charts

Combining techniques

- Information sources: code, documentation and running system



Document analysis

- CaVE method
  - FAQs, tutorials, user guides, designer documentation
- Extraction

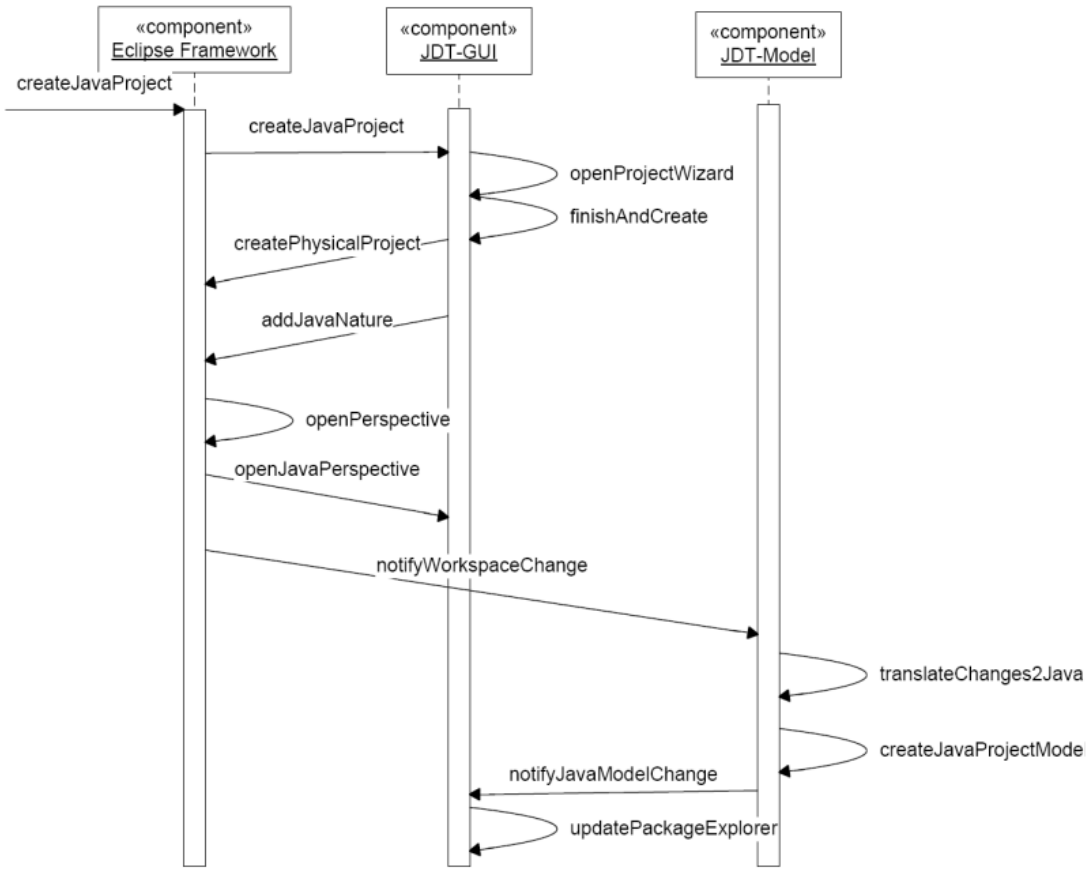
  Concepts, features, use cases, relationships
- Conceptual architectural view

Static analysis

- SAVE method
  - Compare as-intended architecture with as-is architecture
  - Use conceptual model as starting point
  - Obtain source model by parsing the code
  - Reduce no. of lowlevel components
  - Iterate until initial model and source model are aligned

Dynamic analysis

- Extraction of behavioral views



Final words

- Systematical reconstruction
  - Recovery of assets for use in product lines
  - Combination of techniques covers multiple grounds

- Effort?
- Other visualizations?
- Scalability?

Higher Abstractions for Dynamic Analysis

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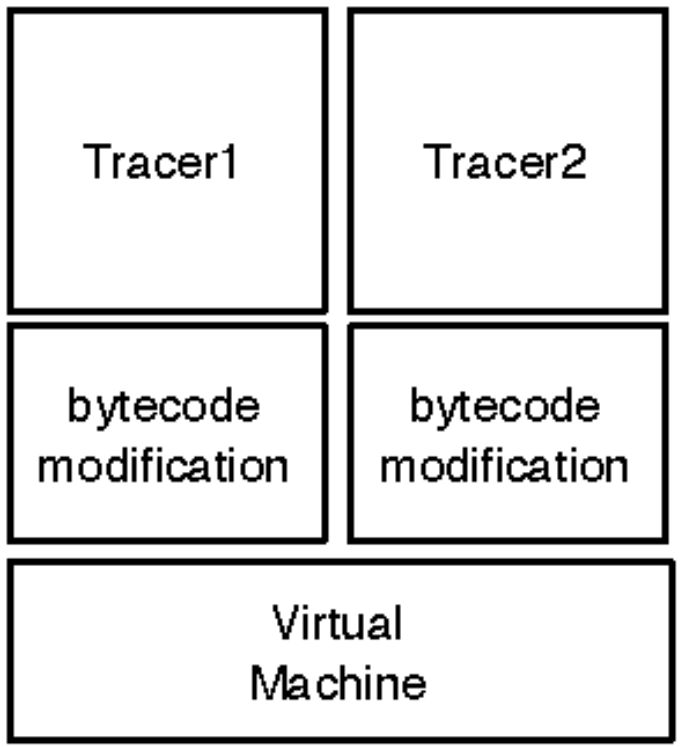
Motivation

- Dynamic analysis
  - Code instrumentation & registration of runtime behavior
  - Requires detailed knowledge of target language

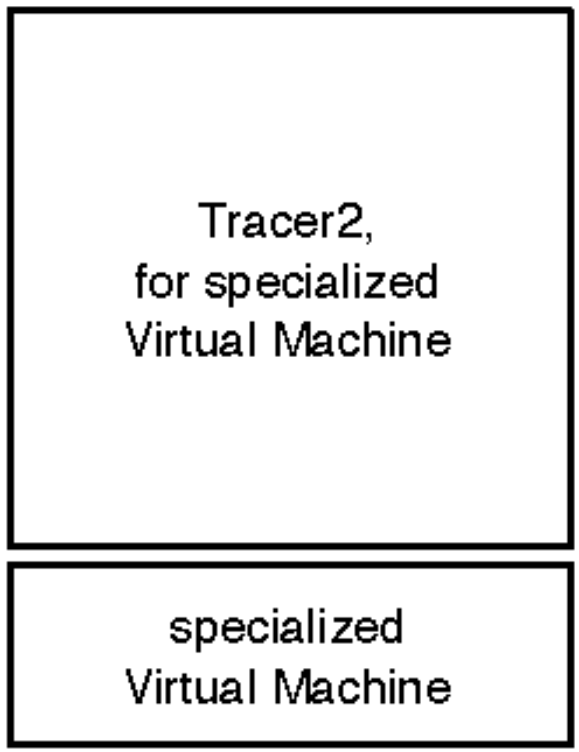
Reinventing the wheel

- Multiple implementations for instrumentation
  - Too much effort



Non-flexible solutions

- Tight coupling between tool and environment
  - Alternate VM requires reimplementation



Proposition

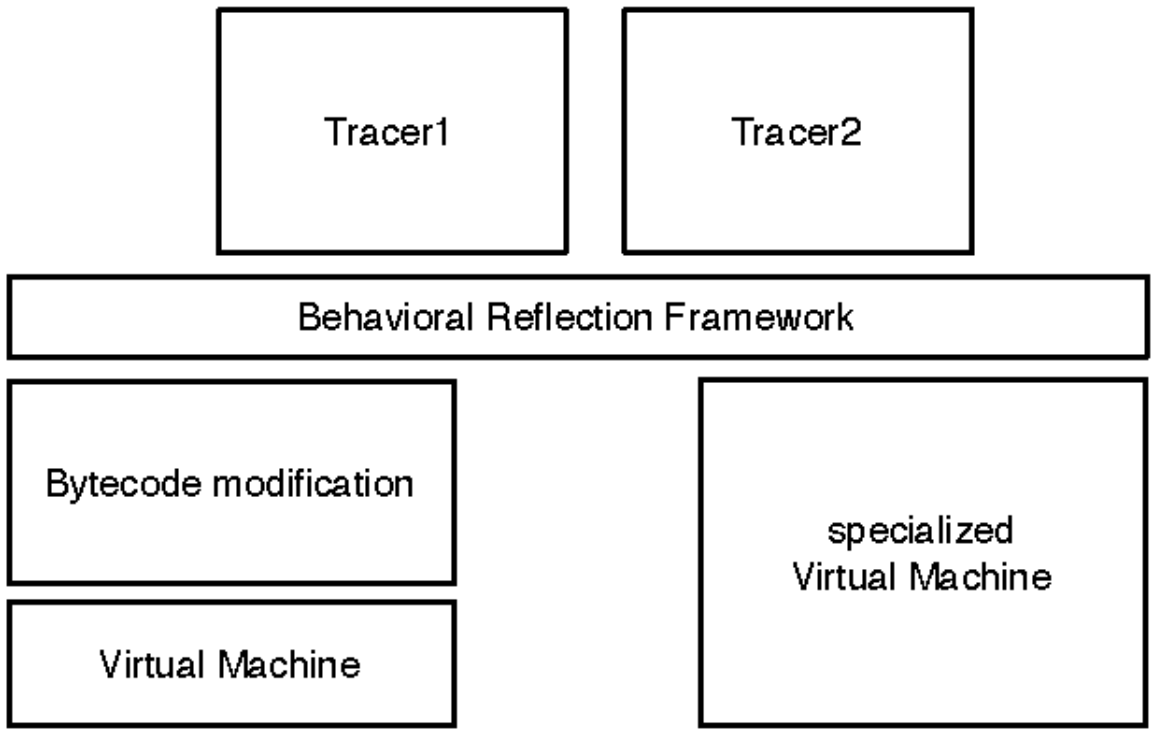
- New abstraction layer
  - Based on behavorial reflection

Behavioral reflection

- Allows a program to modify (at runtime):
  - its own code
  - the semantics and implementation of its own programming language
- Complete dynamic analysis
  - Comprises more than just method executions
  - Need for a reflective meta representation that describes *all* behavorial aspects

Behavioral framework

- Additional abstraction layer



Requirements

- Runtime installation
- Unanticipated use
- Fine-grained selection
- Implementation hiding
- Performance

Final words

- Generic abstraction layer
  - Allows for portable tools
  - Relieves developers of lowlevel detail concerns
- Several requirements
  - Can these be realized?

Discussion

- Feasible?
- How does this abstraction layer compare to Aspect Oriented Programming?

Capturing How Objects Flow at Runtime

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Motivation

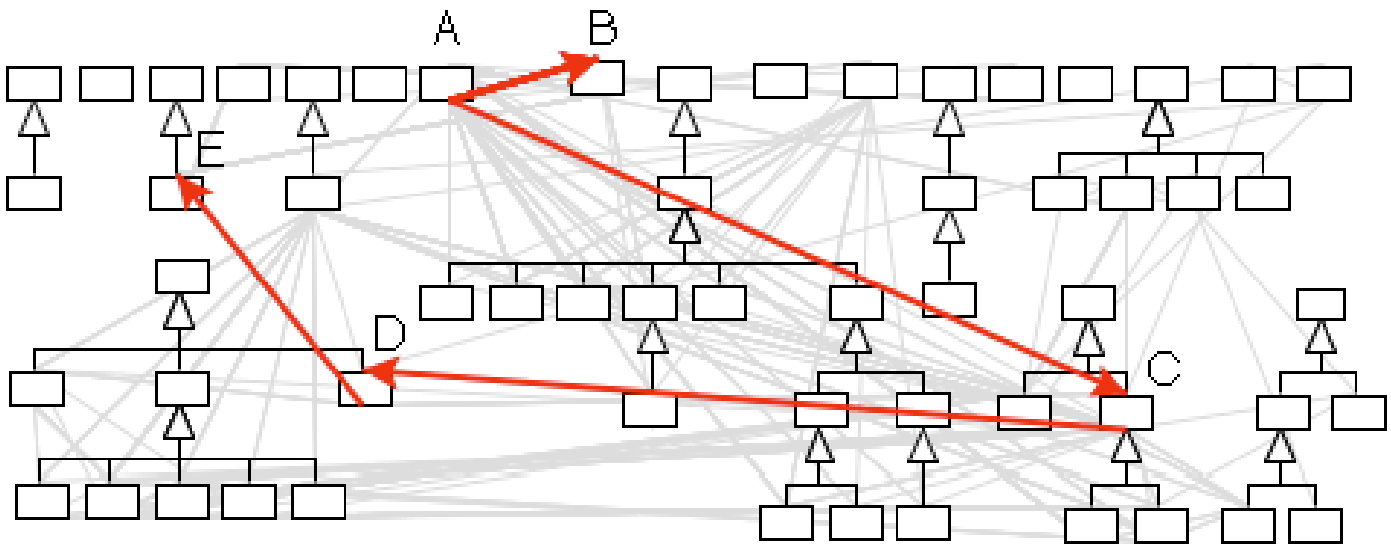
- Dynamic techniques are generally based on trace views
  - Too low level of abstraction for OO systems
- Idea: capture object lifecycles
  - Take aliasing into account
  - Follow propagation of objects at runtime
  - Meta model

Aliases

- Created when an object is:
  - instantiated
  - stored in a field
  - stored in a local variable
  - passed as an argument
  - returned from a method execution

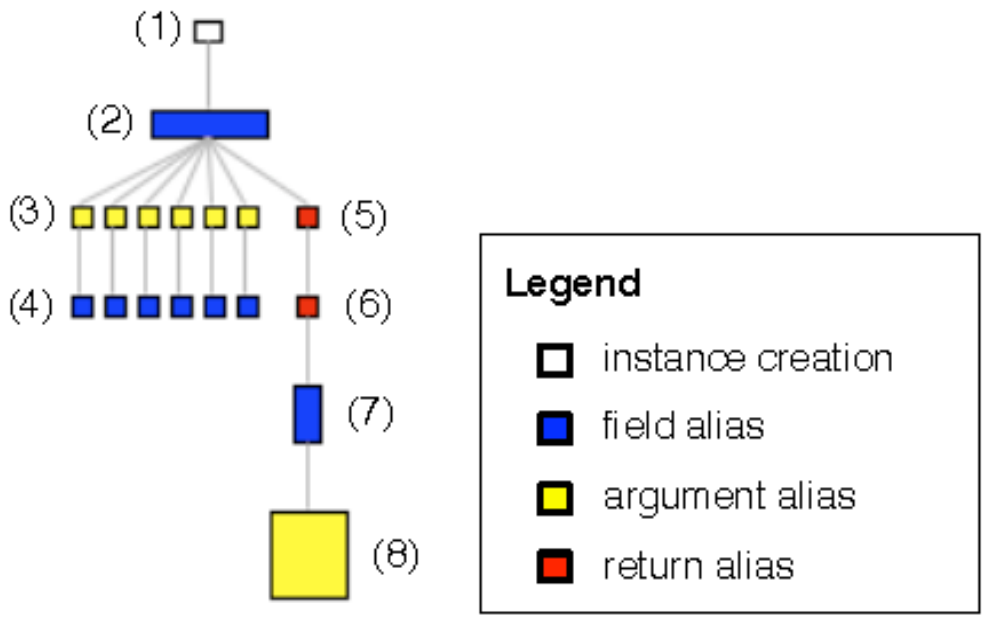
Relating static to dynamic information

- Serves two purposes
  - Check whether objects paths are as expected
  - Identification of important classes in the object flow



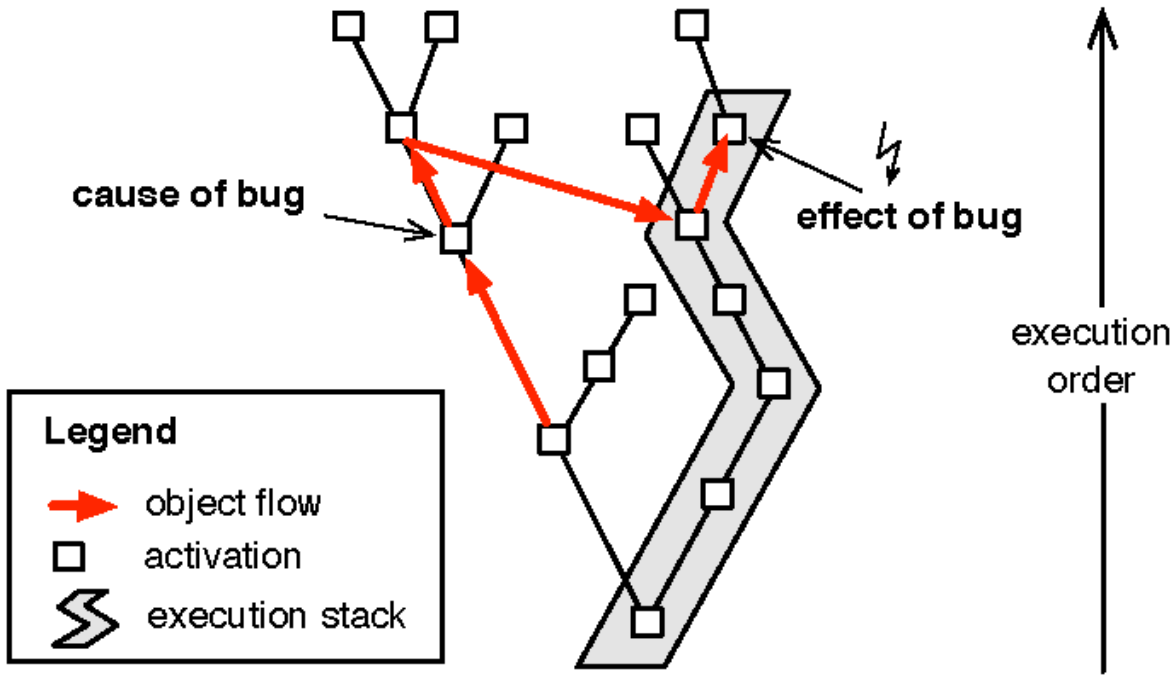
Characterizing object flows

- Purpose
  - Shows an object's interaction with other objects during its lifecycle



Object-centric debugging

- Purpose
  - Support in finding causes and effects of errors



Conclusion

- Need for views on object referencing
  - Alias analysis yields promising results
  - Serves various purposes

Discussion

- Scalability
  - Performance overhead: factor 10
  - Implement aliases at a lower level in the VM
  - Room for improvement?
  - Scalable object visualizations?