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Towards Adaptable Control Flow Segmentation for Measurement-Based Execution Time Analysis

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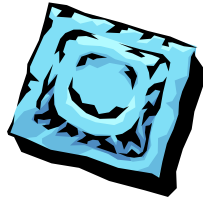
RTNS 2009, Paris, France, October 26-27, 2009

Worst-Case Execution Time Analysis

- Scheduling people want WCET for individual task
- We ***estimate*** the WCET of simple tasks
- Available approaches:
 - Black-box testing + measuring
 - Static code analysis
 - Hybrid approach

Quality Criteria for WCET Analysis

- Safety



- Precision



- Performance

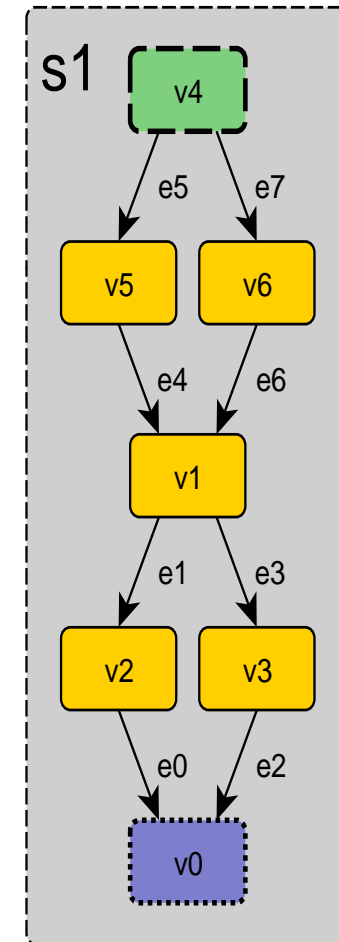


- Accessibility

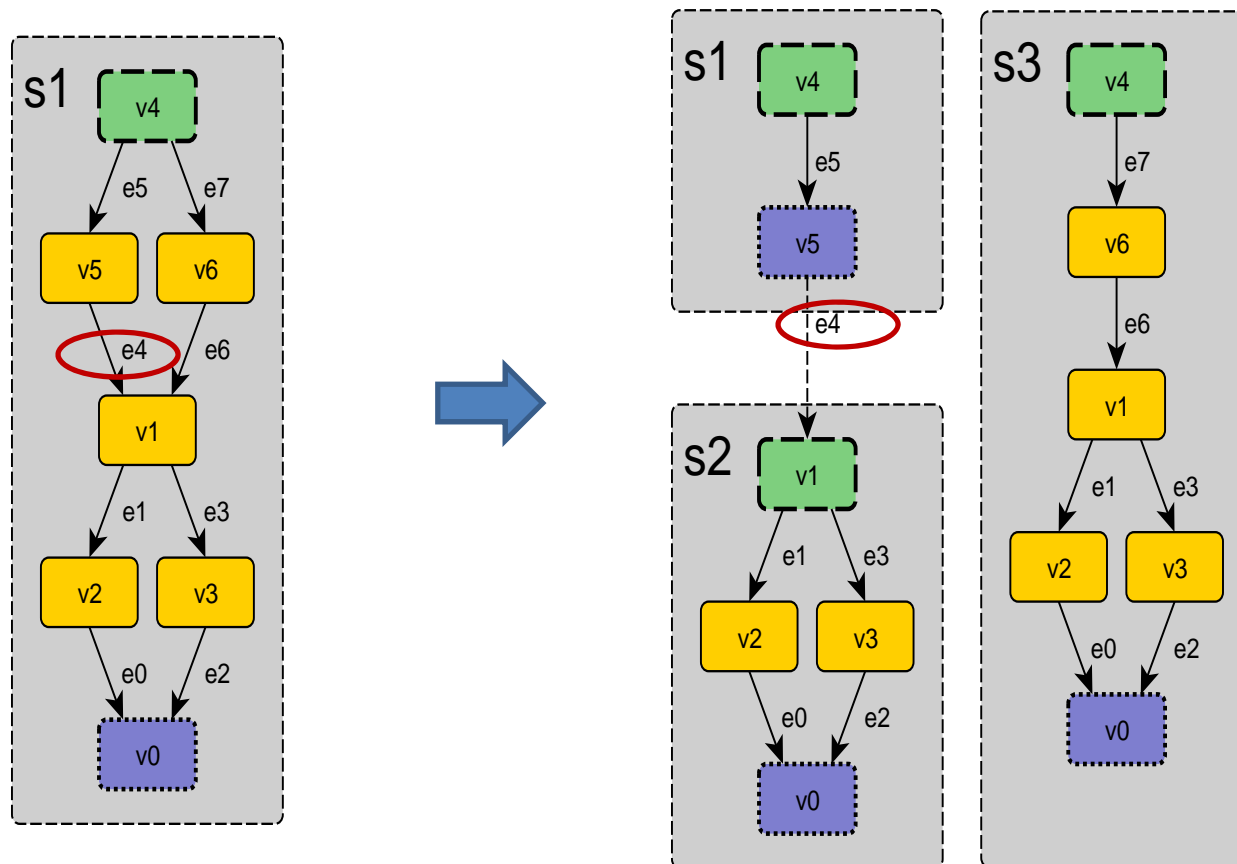


Graph-based Input Data Generation

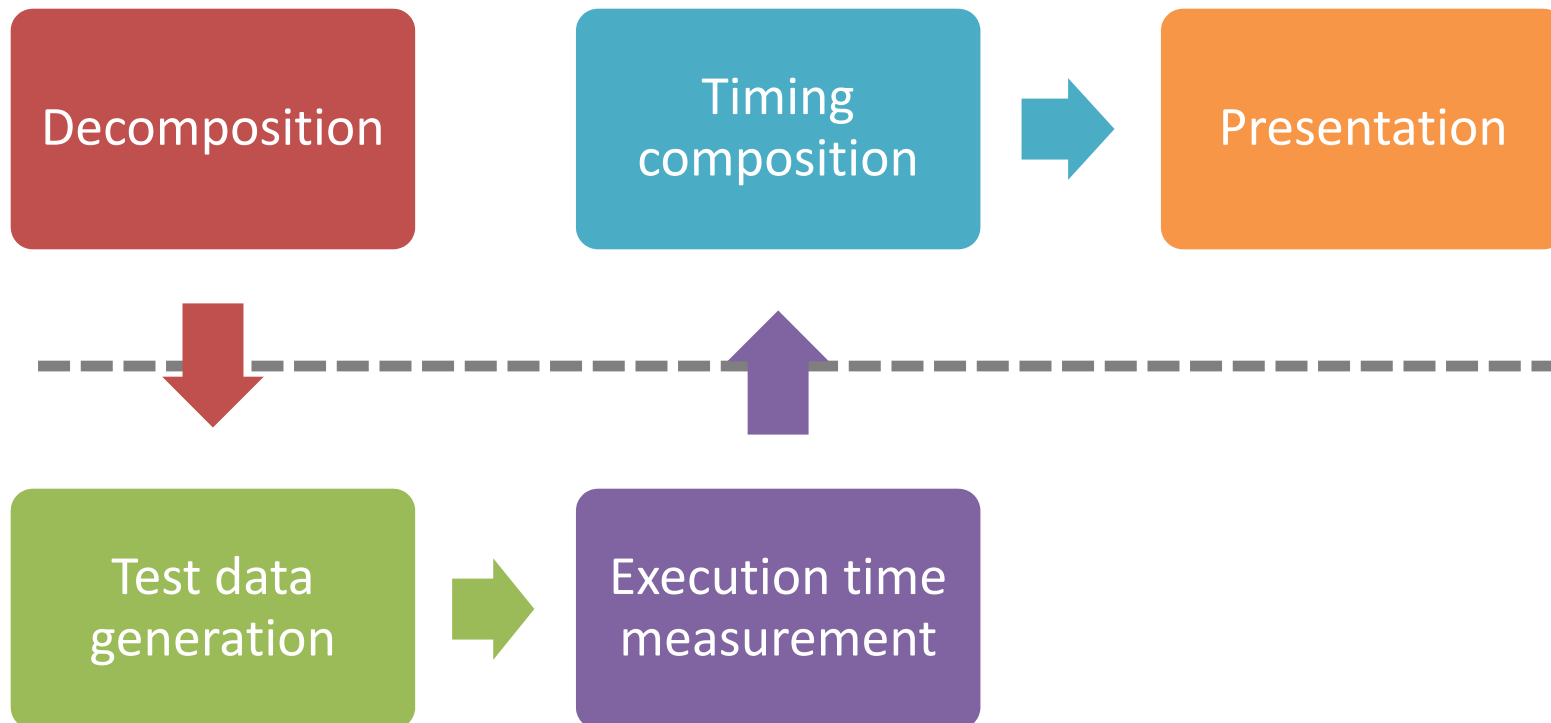
- Graph represents all **possible** operation sequences
 - Path \Leftrightarrow Possible operation sequence
 - Simple case: Control Flow Graph
- In a perfect world: cover all paths!
- Graph is overapproximation of all **feasible** operation sequences
 - Some paths are dynamically infeasible
- Huge number of paths!



Segments: Subsets of Paths

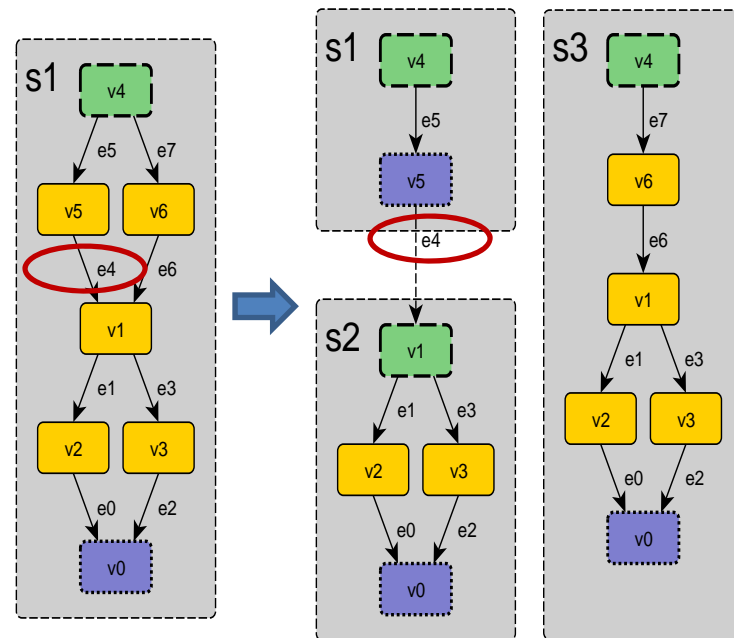


Analysis Process

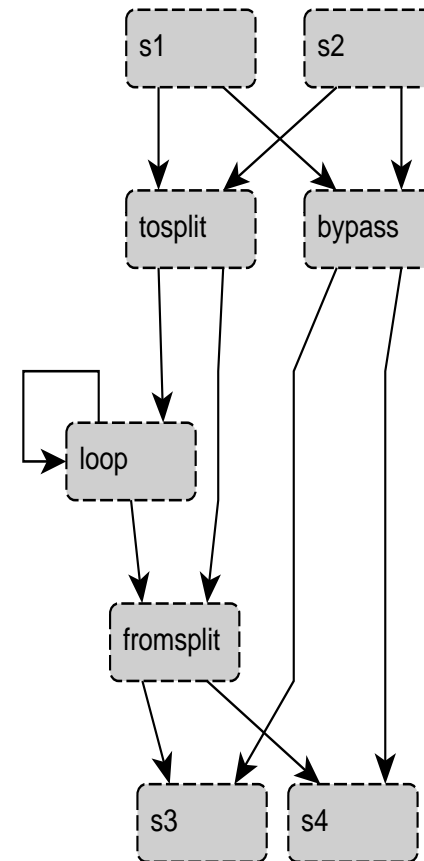
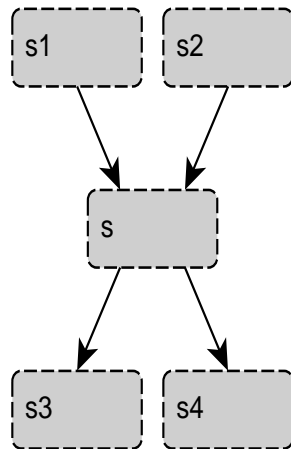


Segmentation Graph

- Nodes: Segments
 - Subgraphs of CFG
 - May overlap
 - Single entry / exit
 - Represent all path passing through
- Edges: CFG edges
- Splitting operation externalizes edge



Segment Splitting



Segmentation Algorithm

- Want segments of tractable size
- Start with one big segment
- Iterative splitting at edge
 - Pick edge with maximum betweenness
- Rapid shrinking of segments

Preliminary Experimental Results

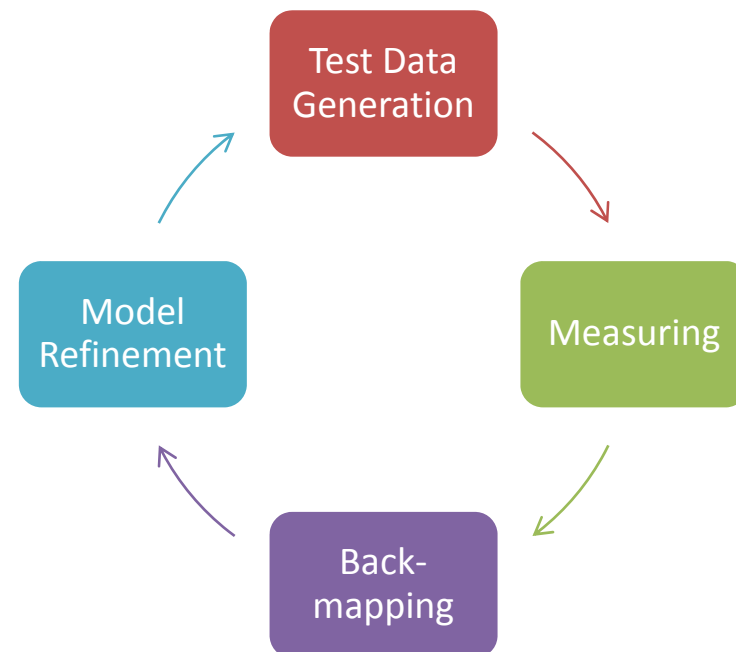
Paths per Segment	1	≤ 100
Number of segments	1 287	73
Overall analysis time	3.4h	52.3h
Pessimism	2 756%	171%

Conclusion

- Measurement-based timing analysis approach
- Segments and Segmentation Graph
- Segmentation algorithm
- Preliminary results

Outlook

- Improve prototype implementation
- More experiments
- Incremental refinement



The End

Thank you for your attention!