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SECURE COMMUNICATIONS AT THE SPEED OF CYBER

Graph Compactification for Efficient Program Comprehension and Analysis

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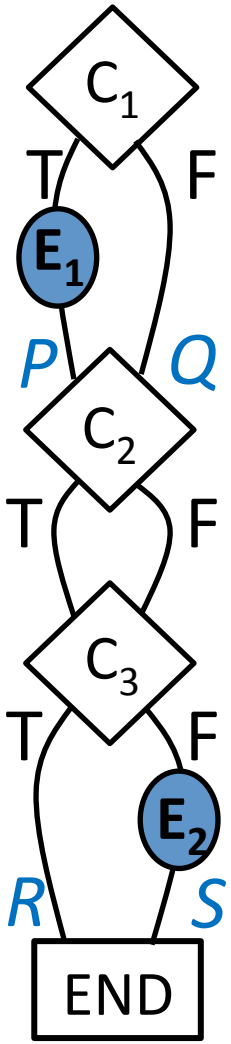
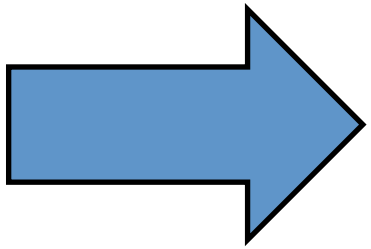
Intuition: Efficient Path-Sensitive Analysis

- A large number of paths could be partitioned into a small number of groups.
- All Paths in a group are equivalent – have the same execution behavior w.r.t. the property to be verified.
- Efficient computation by examining only one path from each group.
- Challenge: How can the groups be formed without examining each path at least once?

Irrelevant Branch Conditions

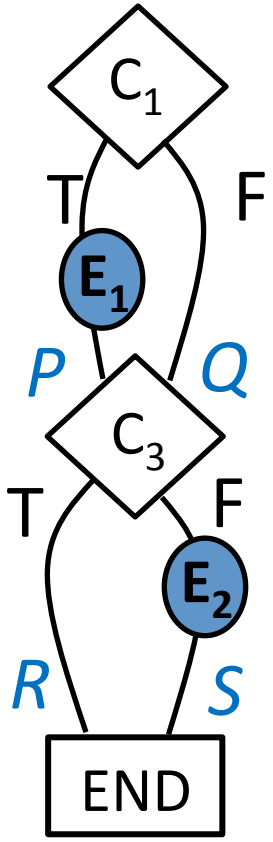


C_2 irrelevant to path-sensitive analysis w.r.t. E_1 and E_2



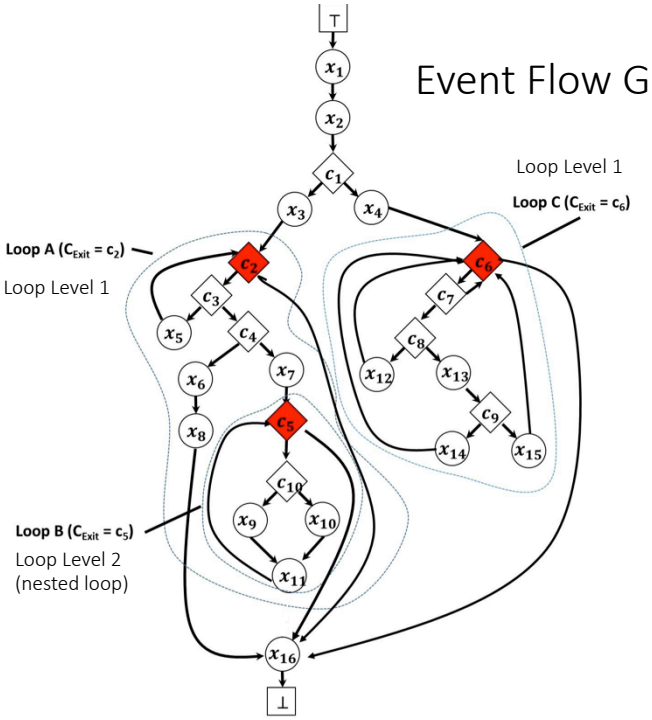
Remove the irrelevant branch conditions to avoid unnecessary path explosion & simplify the path feasibility check.

paths reduced from 8 to 4

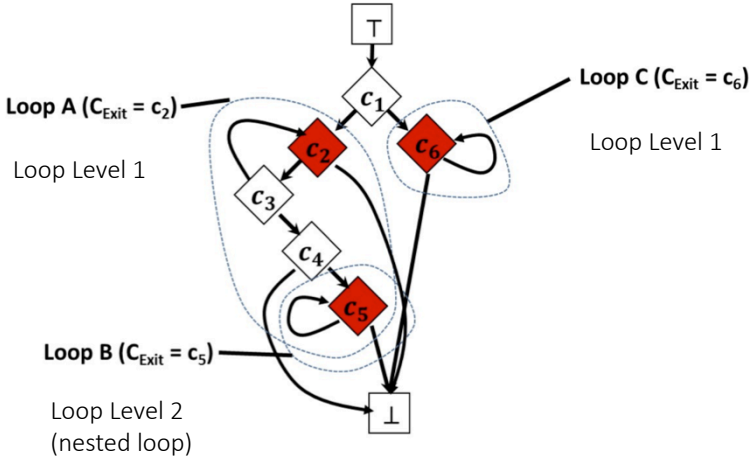


conditions for feasibility check reduced from 3 to 2

Event Flow Graph = Control Flow Graph distilled to retain a given property



Control Flow Graph



Event Flow Graph

Loop Header Event