Symbolic Path-Based Analysis for Fault Detection and Diagnosis

One of the important challenges in developing software is to manage software faults. Since a fault occurs along an execution path, program path information is essential for both detecting and diagnosing a fault. Manual inspection can identify a path where a fault occurs; however, the approach does not scale. Dynamic techniques, such as testing, are also effective in finding faulty paths, but only in a sampled space. In this talk, I present a symbolic analysis framework for automatically detecting the occurrence and propagation of a fault. The framework integrates the novel techniques of demand-driven symbolic analysis and multi-version control flow graphs for scalability, as well as segmented, path-based analysis for precision. It applies a specification technique that enables automatic generation of analyses for detecting different types of faults. In the second part of my talk, I describe how the computed path information can be used to understand and diagnose faults. In particular, I demonstrate that detecting fault correlation—a causal relationship between faults—can help prioritize and group faults, and that my analysis is able to automatically detect such relationships. At the end of the talk, I will discuss several directions of my current and future research projects.

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