

All File Systems Are Not Created Equal: On the Complexity of Crafting Crash-Consistent Applications

Summary and Strengths:

The objective of this paper is to investigate and explore on the study of application-level crash-consistency protocols built on present-day filesystems. Applications use complex update protocols for state persistence, and the correctness of these protocols highly depend on persistence characteristics. Persistence characteristics are the subtle behaviors of the underlying filesystem. The paper introduces BOB, a tool that tests persistence properties, which could vary widely among filesystems in Linux. The ALICE framework analyzes application update protocols and finds code parts that are vulnerable to crash, based on the properties of persistence needed. It also can evaluate new filesystem designs in terms of application-level consistency. The paper effectively showed how the dependence of application-level consistency on filesystem persistence can cause a serious consequence. 11 instances of widely used systems were analyzed, and as much as 60 vulnerabilities were detected, some of which may invoke severe issues like loss of data or corruption.