Software developers commonly use frameworks, software abstractions where generic functionality for a focused domain is specialized or overwritten for new applications. Frameworks allow developers to reuse code known to work in that domain, which significantly reduces development costs. Frameworks provide this reuse by controlling the structure and execution flow of applications. In doing so, frameworks locate information required for debugging framework application problems, such as object state changes and call information, in internal framework code, increasing the challenges associated with fixing application problems. These challenges motivated a study on the challenges that framework application developers face when debugging framework applications. The results from this study showed that developers would benefit from an automated repair technique for framework applications and led to the following thesis statement: Framework application developers encounter distinct challenges when reusing the architecture provided by frameworks, such as framework state constraints. An automated repair technique that exploits the similarities between framework state constraints can fix violations of these constraints in an accurate and general manner.

In this talk, I will talk about how I identified the challenges that developers face when debugging framework applications, which I identified through an exploratory study into debugging problems from the Android and Robotic Operating System (ROS) framework. One challenge area I identified in the debugging study was state-based based debugging issues. This discovery motivated an automated repair tool to fix state-based bugs in framework applications. For the rest of the talk, I will discuss my approach to automatically identifying these issues in framework applications, using an application programming interface (API) based specification technique that is converted into a static analysis check. I will also discuss a technique for automatically repairing these problems that both moves methods calls and uses reference applications, exploiting common framework application designs. This approach was evaluated on the F-Droid dataset, a marketplace of open source Android applications, and was found to be able to identify and repair bugs in applications.

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