MACE: Detecting privilege escalation vulnerabilities in web applications for CCS 2014

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Abstract

We explore the problem of identifying unauthorized privilege escalation instances in a web application. These vulnerabilities are typically caused by missing or incorrect authorizations in the server side code of a web application. The problem of identifying these vulnerabilities is compounded by the lack of an access control policy specification in a typical web application, where the only supplied documentation is in fact its source code. This makes it challenging to infer missing checks that protect a web application's sensitive resources. To address this challenge, we develop a notion of authorization context consistency, which is satisfied when a web application consistently enforces its authorization checks across the code. We then present an approach based on program analysis to check for authorization state consistency in a web application. Our approach is implemented in a tool called MACE that uncovers vulnerabilities that could be exploited in the form of privilege escalation attacks. In particular, MACE is the first tool reported in the literature to identify a new class of web application vulnerabilities called Horizontal Privilege Escalation (HPE) vulnerabilities. MACE works on large codebases, and discovers serious, previously unknown, vulnerabilities in 5 out of 7 web applications tested. Without MACE, a comparable human-driven security audit would require weeks of effort in code inspection and testing. Copyright is held by the owner/author(s).