Information Flow and Multilevel Information Systems

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Abstract

The security analysis of systems able to process information with different security levels by users with different security clearances and needs-to-know is an active domain of research. The modeling of such systems is complex and many access control models have been proposed in the past. These models have to take into account new issues as the concept of information flows. For instance, many database models provide dynamic mechanisms like the triggers. Such mechanisms introduce specific security problems that are not addressed in previous database security models. Besides, most of the multilevel system models fail to express advanced concepts. An example of these advanced notions is the control of sensitive information downgrading, which consists in allowing accesses that were previously denied by diminishing the security level of the information. This failure relies on the fact that information downgrading requires the definition of formal security models able to express contextual authorizations for some information flows.

In this presentation, we will first present general definitions for the multilevel information system, information flow and downgrading concepts. We will then discuss the mentioned issues. As a first discussion, we will present our contribution concerning the modeling of the downgrading concept. We will study the modeling of an expressive security model for information management and we will then consider the concept of downgrading. As a second discussion, we will present information flow issues in recent active database concepts, based on the ECA rules paradigm. We will present how to model information and take them into account, by defining both standard and advanced security properties.

Keywords: data management, information flow, downgrading, modeling, databases, ECA rules, B Method, proofs