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TEACHING DATABASE SECURITY USING A SET OF SOFTWARE ANIMATIONS

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ABSTRACT

This workshop introduces a set of software animations developed to support the teaching of database security concepts. The animations are part of an animated database courseware project supported by an NSF Course, Curriculum and Laboratory Improvement grant. The courseware has been made publicly available and may be accessed at <http://adbc.kennesaw.edu>

Keywords

Database security, instructional animations

OVERVIEW

As the amount of data collected, stored and retained electronically, continues to grow, so does the need to understand database security. Traditionally database security focused on user authentication and managing user privileges to database objects. This has proven to be inadequate given the growing number of successful database hacking incidents and the increase in the number of organizations reporting loss of sensitive data. It is becoming imperative for students in the computing disciplines to develop an understanding of the issues and challenges related to database security and their possible solutions. While database security, in totality, includes computer and network security, data security is focused on data protection and data integrity.

Database security is often included as a topic in an introductory database course but generally there is not enough time to engage students in developing broad or deeper understandings in this area. Further, many topics related to database security are complex and require students to engage in active learning to fully comprehend the fundamental nature of database security challenges. This workshop introduces a set of software animations developed to support the teaching of database security concepts. The animations are part of an animated database courseware project supported by an NSF Course, Curriculum and Laboratory Improvement grant. The courseware has been made publicly available and may be accessed at <http://adbc.kennesaw.edu>.

Animations in the database security module are designed around four areas: integrity, database application security, database security and auditing procedures. Specifically the topics to be covered include:

- **Referential integrity** – Referential integrity is one of the most important concepts related to preserving data accuracy in relational database systems. These animations demonstrate referential integrity as applied to update and delete actions.
- **Security Matrix** – A security matrix (also known as a CRUD) matrix identifies the possible operations (create, read, update, delete) or authorizations needed between database tables and input/output sources such as forms and reports. This animation includes a simulated security matrix and an accompanying interactive quiz.
- **Row Level Security** - Row level security is a fundamental database concept. It is a very common practice to restrict user access to data such that, for instance, a user is only able to view or modify the row or rows of data that correspond to them. A common way to implement row level security is through the use of views. This animation demonstrates creating a view and assigning user permission to that view in order to restrict user access.
- **SQL Injection** - SQL injections are a major security threat that embodies one of the most important security issues, risks inherent to non-validated user input. The SQL inject vulnerability is primarily the result of user input resulting

in dynamically created SQL statements. The ADbC provides a set of concrete examples demonstrating commonly published SQL injections such as those occurring from a login page and a free form search query entry.

- Inference - A subtle vulnerability found within database technologies is inference, or the ability to derive unknown information based on retrieved information. The problem with inference is that there are no ideal solutions to the problem. However, it is important for students to understand the risks of inference and how it might occur. Three animations are provided that demonstrate how users might be able to put together (infer) information when data is available to those with a higher security access level or when they are given access to aggregate data.
- Database Auditing - Database auditing is used to track database access and user activity. While it does not prevent security breaches, it provides a way to identify if breaches have occurred. Database auditing is implemented using log files and audit tables. Animations are included that demonstrate the auditing of user sessions and changes to table structure. In addition, an example of using the Oracle audit trail facility is included as well as an overview of the need to audit default accounts installed by many database systems.

The ADbC was developed to provide instructional materials to supplement classroom teaching. The modules are designed to be independent of any database text or database product. The intended audience for this workshop includes faculty members or instructors who teach a database course or teach a class with a database component. Faculty who teach other courses within the computing disciplines and students that are either taking a database class or have taken a database class will also find the workshop useful. The workshop will demonstrate both how the animations work and ways in which they might be utilized in the classroom.

REFERENCES

1. Animated Database Courseware (ADbC). Available online : <http://adbc.kennesaw.edu>