Security and Authorization

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CS 348
Introduction to Database Management
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Content of certain slides due to R. Ramakrishnan and J. Gehrke

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Outline

- 1 Introduction
- ② Discretionary Access Control Granting and Revoking Privileges Views
- 3 Mandatory Access Control
 The Bell-LaPadula Model
 Multilevel Relations

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Objectives in Securing an Information System

- Secrecy Information should only be shown to people who are allowed to see it.
- Integrity Information should only be modified by people who are allowed to modify it.
- Availability If someone is allowed to see and/or modify data, they should be able to do so.

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Access Control

A security policy defines who should be allowed to see and/or modify specific data in the system.

- A DBMS provides access control mechanisms to help implement a security policy.
- Two complementary types of mechanisms:
 - 1 Discretionary access control
 - 2 Mandatory access control

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Discretionary Access Control

Idea

Achieve security by specifying which schema objects a user may access.

- Users are given privileges to access the appropriate schema objects (tables, views).
- Users can grant privileges to other users at their own discretion.
- Implementation: GRANT and REVOKE commands

In SQL-92, privileges are assigned to users.

In SQL:1999, privileges are assigned to *roles*, which are then granted to users.

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Granting/Revoking Privileges

GRANT privileges ON object TO users [WITH GRANT OPTION]

REVOKE [GRANT OPTION FOR] privileges ON object

FROM users { RESTRICT | CASCADE }

- Possible privileges:
 - SELECT
 - INSERT (column)
 - UPDATE (column)
 - DELETE
 - REFERENCES (column)
- WITH GRANT OPTION allows user to pass on privilege (with or without passing on grant option)
- When a privilege is revoked from user X, it is also revoked from all users that were granted the privilege solely from X

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Views

- Views can be used to allow access to only certain tuples from a table
- The view creator has same privileges on the view as on the underlying tables
- A view is dropped if the view creator loses SELECT privileges on underlying tables/views

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Mandatory Access Control

Idea

Achieve security by specifying which data (i.e. instance) objects a user may access.

- Discretionary AC is susceptible to Trojan Horse attacks:
 - If user X tricks user Y into copying data from table A into table B, then the access control on table A doesn't apply to the copy of the data in table B
- In Mandatory AC, system-wide policies govern who can see which data objects, independent of the data lineage

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The Bell-LaPadula Model

- Objects (tables, views, rows, columns) are assigned security classes
- Subjects (users, roles, programs) are assigned security clearances
- Sample classes/clearances: Top Secret, Secret, Confidential, Unclassified

Goal

Information should never flow from a higher to a lower class.

Restrictions enforced by the DBMS:

- 1 Subject S can read object O only if clearance(S) \geq class(O)
- 2 Subject S can write object O only if clearance(S) \leq class(O)

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Multilevel Relations

Individual tuples or columns can be assigned security classes

⇒ users with different clearances see different tables

Fighters

Name	Threat	Security Class
Sopwith Pup	Harmless	Unclassified
MiG-29 Fulcrum	Extremely Dangerous	Top Secret

Users with clearance TS see two rows; other users see only one.

To avoid revealing any information about the MiG-29 Fulcrum, the Security Class must be treated as part of the key.

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