Lecture 16: Security and Authorization

EGCI 321: DATABASE SYSTEM (WEEK 11)

Outline

1. Introduction
2. Discretionary Access Control
   - Granting and Revoking Privileges
3. Mandatory Access Control

Objective 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.

Access Control

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

- A DBMS provided access control mechanisms to help implement a security policy.

Two complementary types of mechanisms:

1. *Discretionary access control*
2. *Mandatory access control*

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 user.

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
- REFERENCE (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*

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

Mandatory Access Control

Idea: Achieve security by specifying which *data (i.e. Instance) objects* that 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 does not 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 linage

The Bell-LaPadula Model

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

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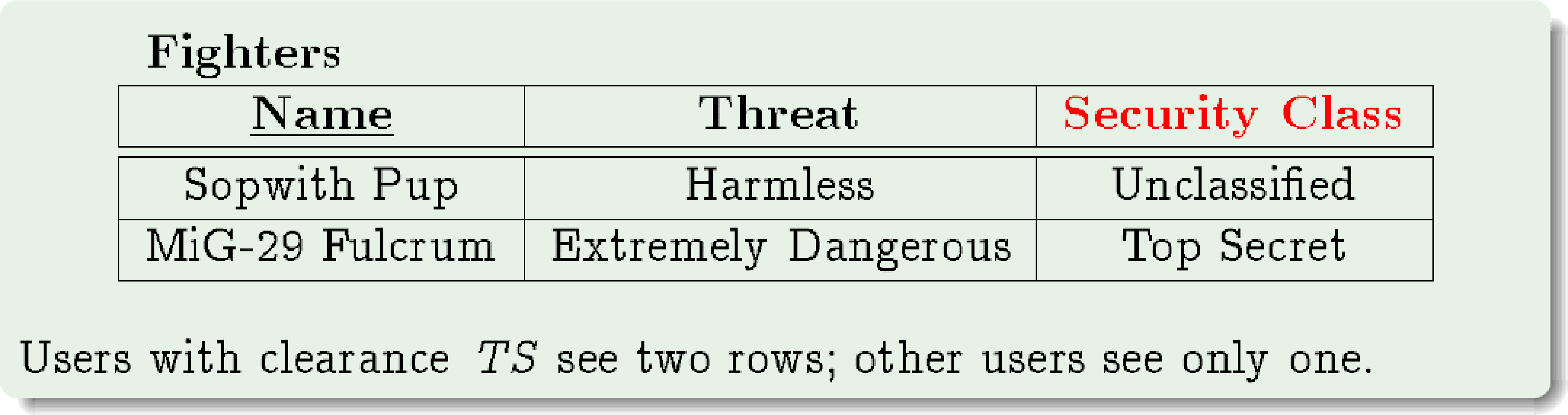
GOAL: information should never flow from a higher to a lower class.

Restrictions enforced by the DBMS:

1. Subject S can read object O only if clearance(S) >= class(O)
2. Subject S can write object O only if clearance(S) <= class (O)

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.

User Management

Create new login

```
CREATE USER egci321 IDENTIFIED BY 'egci321egci321’;
```

Show all users

```
SELECT USER FROM mysql.user;
```

Lock/Unlock Account

```
ALTER USER egci321 ACCOUNT LOCK;
```

```
ALTER USER egci321 ACCOUNT UNLOCK;
```

Show Locked/Unlocked Account Status

```
SELECT User, Host, account_locked FROM mysql.user;
```

User Management

Grant privilege

```
GRANT SELECT ON concurrency.Balance TO egci321;
FLUSH PRIVILEGES;
SHOW GRANTS FOR egci321;
```

Revoke privilege

```
REVOKE SELECT ON concurrency.Balance FROM egci321;
FLUSH PRIVILEGES;
```

Revoke all privileges

```
REVOKE ALL PRIVILEGES, GRANT OPTION FROM egci321;
```

Drop user

```
DROP USER 'egci321';
```

Database Management

Read-only Database

```
ALTER DATABASE concurrency READ ONLY = 0;
```

Read-Write Database

```
ALTER DATABASE concurrency READ ONLY = 1;
```

Reference

1. Ramakrishnan R, Gehrke J., Database management systems, 3rd ed., New York (NY): McGraw-Hill, 2003.