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Security and User Authorization in SQL

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Types of Security

- Legal and ethical issues regarding the right to access certain information
- Policy issues at the governmental, institutional, or corporate level.
- System related issues such as the system levels at which various security functions should be enforced
- Multiple security levels (top secret, secret, confidential, unclassified)

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Threats to databases

- *Loss of integrity*: information must be protected from improper modification
- *Loss of availability*: data must be available to users/programs if they have a legitimate right to it
- *Loss of confidentiality*: data must be protected from unauthorized disclosure

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Countermeasures

- *Access control*: user accounts, passwords, privileges
- *Inference control*: forbids inferring certain facts(about individuals) from statistical databases
- *Flow control* prevents information from “flowing” in such a way that it reaches unauthorized users
- *Encryption* protects sensitive data that is being transmitted via some type of communications network

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User Accounts

```
CREATE USER ‘monty’@‘localhost’ IDENTIFIED BY ‘password’;
CREATE USER ‘monty’@‘%’ IDENTIFIED BY ‘password’;
```

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Authorization: FS

- A file system identifies certain privileges on the objects (files) it manages.
  (read, write, execute)

- A file system identifies certain participants to whom privileges may be granted.
  (the owner, a group, all users)

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Privileges in SQL

SQl defines nine types of privileges, among which the most important are:

- *SELECT* - right to query the relation.
- *INSERT* - right to insert tuples.
- *DELETE* - right to delete tuples.
- *UPDATE* - right to update tuples.

SELECT, INSERT, UPDATE may apply to only one attribute of the table!

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Privileges in SQL: example

```
INSERT INTO Beers(name)
SELECT beer FROM Sells WHERE NOT EXISTS
(SELECT * FROM Beers WHERE name = beer);
```

What privileges are required to execute such a query?

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Views as access control

Employees(name, address, salary)

```
CREATE VIEW ModifiedEmployees
AS SELECT name, address FROM Employees;
```

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Creating Privileges

SQL elements such as schemas have an owner (There is an *authorization ID* associated). The owner has all privileges associated with the schema/object.

```
GRANT <privilege list> ON <database element> TO <user list>
[ WITH GRANT OPTION]
```

- Shorthand for all privileges: ALL PRIVILEGES
- If you want the recipient(s) to be able to pass the privileges to others use: WITH GRANT OPTION

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GRANT example

```
GRANT SELECT, UPDATE(price) ON Sells TO sally;
```

```
GRANT UPDATE ON Sells TO sally WITH GRANT OPTION;
```

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REVOKING privileges

REVOKE <privilege list> ON <database element> FROM <user list> [CASCADE, RESTRICT]

- CASCADE. Any grants made by a revokee are also not in force, no matter how far the privilege was passed.
- RESTRICT. If the privilege has been passed to others, the REVOKE fails as a warning that something else must be done to remove the privilege dcompletely.

REVOKE GRANT OPTION FOR can be used to revoke just grant privileges.