SQL Authorization

Privileges
Grant and Revoke
Grant Diagrams

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Authorization

- A file system identifies certain privileges on the objects (files) it manages.
  - Typically read, write, execute.
- A file system identifies certain participants to whom privileges may be granted.
  - Typically the owner, a group, all users.

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Privileges --- (1)

- SQL identifies a more detailed set of privileges on objects (relations) than the typical file system.
- Nine privileges in all, some of which can be restricted to one column of one relation.

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Privileges --- (2)

- Some important privileges on a relation:
  1. SELECT = right to query the relation.
  2. INSERT = right to insert tuples.
     - May apply to only one attribute.
  3. DELETE = right to delete tuples.
  4. UPDATE = right to update tuples.
     - May apply to only one attribute.

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Example: Privileges

- For the statement below:

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

beers that do not appear in Beers. We add them to Beers with a NULL manufacturer.

- We require privileges SELECT on Sells and Beers, and INSERT on Beers or Beers.name.

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Authorization ID's

- A user is referred to by *authorization ID*, typically their name.
- There is an authorization ID PUBLIC.
  - Granting a privilege to PUBLIC makes it available to any authorization ID.

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Granting Privileges

- You have all possible privileges on the objects, such as relations, that you create.
- You may grant privileges to other users (authorization ID's), including PUBLIC.
- You may also grant privileges WITH GRANT OPTION, which lets the grantee also grant this privilege.

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The GRANT Statement

- To grant privileges, say:
  GRANT <list of privileges>
  ON <relation or other object>
  TO <list of authorization ID's>;
- If you want the recipient(s) to be able to pass the privilege(s) to others add:
  WITH GRANT OPTION

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Example: GRANT

- Suppose you are the owner of Sells. You may say:

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

- Now Sally has the right to issue any query on Sells and can update the price component only.

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Example: Grant Option

- Suppose we also grant:

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

- Now, Sally not only can update any attribute of Sells, but can grant to others the privilege UPDATE ON Sells.
  - Also, she can grant more specific privileges like `UPDATE(price) ON Sells`.

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Revoking Privileges

REVOKE <list of privileges>
ON <relation or other object>
FROM <list of authorization ID's>;

- Your grant of these privileges can no longer be used by these users to justify their use of the privilege.
  - But they may still have the privilege because they obtained it independently from elsewhere.

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REVOKE Options

- We must append to the REVOKE statement either:
  1. CASCADE. Now, any grants made by a revokee are also not in force, no matter how far the privilege was passed.
  2. RESTRICT. If the privilege has been passed to others, the REVOKE fails as a warning that something else must be done to "chase the privilege down."

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Grant Diagrams

- Nodes = user/privilege/option/isOwner?
  - UPDATE ON R, UPDATE(a) on R, and UPDATE(b) ON R live in different nodes.
  - SELECT ON R and SELECT ON R WITH GRANT OPTION live in different nodes.
- Edge *X* -> *Y* means that node *X* was used to grant *Y*.

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Notation for Nodes

- Use *AP* for the node representing authorization ID *A* having privilege *P*.
  - *P** represents privilege *P* with grant option.
  - *P*** represents the source of the privilege *P*. That is, *AP*** means *A* is the owner of the object on which *P* is a privilege.
    - Note ** implies grant option.

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Manipulating Edges --- (1)

- When *A* grants *P* to *B*, We draw an edge from *AP** or *AP*** to *BP*.
  - Or to *BP** if the grant is with grant option.
- If *A* grants a subprivilege *Q* of *P* [say UPDATE(a) on R when *P* is UPDATE ON R] then the edge goes to *BQ* or *BQ**, instead.

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Manipulating Edges --- (2)

- Fundamental rule: User *C* has privilege *Q* as long as there is a path from *XQ*** (the origin of privilege *Q*) to *CQ*, *CQ**, or CQ**.
  - Remember that XQ** could *be* CQ**.
  - Also: the path could be from a superprivilege of *Q*, rather than *Q* itself.

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Manipulating Edges --- (3)

- If *A* revokes *P* from *B* with the CASCADE option, delete the edge from *AP* to *BP*.
- If *A* uses RESTRICT, and there is an edge from *BP* to anywhere, then reject the revocation and make no change to the graph.

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Manipulating Edges --- (4)

- Having revised the edges, we must check that each node has a path from some ** node, representing ownership.
- Any node with no such path represents a revoked privilege and is deleted from the diagram.

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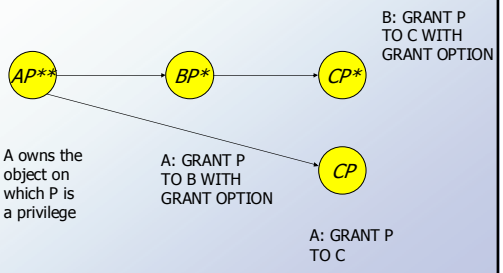
Example: Grant Diagram



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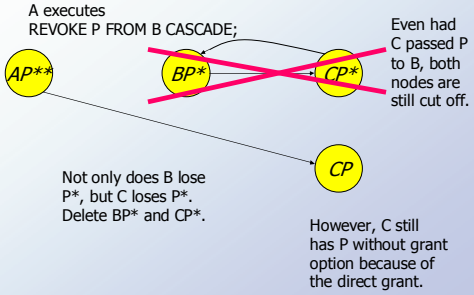
Example: Grant Diagram



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