

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 can not only 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 $X \rightarrow Y$ 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^{**} .

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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.

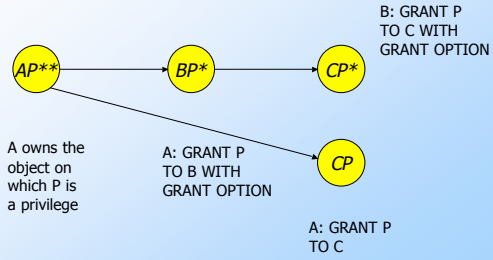
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Manipulating Edges --- 4

- ◆ 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.

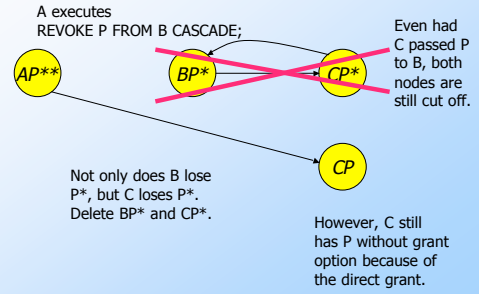
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Example: Grant Diagram



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Example: Grant Diagram



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