SQL Views

COSC 304 – Introduction to Database Systems

Views

A ***view*** is a named query that is defined in the database.

- To the user, a view appears just like any other table and can be present in any SQL query where a table is present.

A view may either be:

- *virtual* - produced by a SQL query on demand.
- *materialized* - the view is stored as a derived table that is updated when the tables that it refers to are updated.

Creating Views

Views are created using the **CREATE VIEW** command:

```
CREATE VIEW viewName [(col1,col2,...,colN)]
AS selectStatement
```

Notes:

- Select statement can be any SQL query and is called the ***defining query*** of the view.
- It is possible to rename the columns when defining the view, otherwise they default to the names produced by the query.

Views Example

Create a view that has only the employees of department `'D2'`:

```
CREATE VIEW empD2
AS SELECT * FROM emp WHERE dno = 'D2';
```

Create a view that only shows the employee number, title, and name:

```
CREATE VIEW staff (Number, Name, Title)
AS SELECT eno, ename, title FROM emp;
```

- The first example is a *horizontal view* because it only contains a subset of the rows.
- The second example is a *vertical view* because it only contains a subset of the columns.

Removing Views

Views are removed using the **DROP VIEW** command:

```
DROP VIEW viewName [RESTRICT|CASCADE]
```

Notes:

- `RESTRICT` will not delete a view if other views are dependent on it.
- `CASCADE` deletes the view and all dependent views.

View Resolution

When a query uses a view, the process of ***view resolution*** is performed to translate into a query over only the base relations.

```
CREATE VIEW staff (Number,Name,Job)
AS SELECT eno,ename,title FROM emp WHERE dno = 'D2';

SELECT Number, Name FROM staff
WHERE job = 'EE' ORDER BY Number;
```

Step #1: Replace column names in `SELECT` clause with names in defining query.

```
SELECT eno, ename FROM staff
WHERE job = 'EE' ORDER BY Number;
```

View Resolution (2)

Step #2: View names in FROM clause replaced by FROM clause in defining query.

```
SELECT eno, ename FROM emp
WHERE job = 'EE' ORDER BY Number;
```

Step #3: WHERE clause of user and defining query are combined. Replace column view names with names in defining query.

```
SELECT eno, ename FROM emp
WHERE title = 'EE' AND dno = 'D2' ORDER
BY Number;
```

View Resolution (3)

Step #4: `GROUP BY` and `HAVING` clause copied to user query from defining query. (no change in example)

```
SELECT eno, ename FROM emp
WHERE title = 'EE' AND dno = 'D2' ORDER BY Number;
```

Step #5: Rename fields in `ORDER BY` clause.

```
SELECT eno, ename FROM emp
WHERE title = 'EE' AND dno = 'D2' ORDER BY eno;
```

View Updatability

When a *base table is updated*, all views defined over that base table are automatically updated. When an *update is performed on the view*, it is possible to update the underlying table.

A view is only *updatable* if:

- does not use `DISTINCT`
- every element in `SELECT` is a column name (no derived fields)
- contains all fields of base relation that are non-NULL
- `FROM` clause contains only one table
- `WHERE` does not contain any nested selects
- no `GROUP BY` or `HAVING` in defining query

In practice, a view is only updatable if it uses only a single table, and any update through the view must not violate any of the integrity constraints of the table.

View WITH CHECK OPTION

WITH CHECK OPTION is used for updatable views to prevent updates through a view that would remove rows from the view.

```
CREATE VIEW staff (Number,Name,Job,DeptNum)
AS SELECT eno,ename,title,'D2' FROM emp
                    WHERE DeptNum = 'D2';

UPDATE staff SET DeptNum = 'D3' WHERE Number='E3';
```

This update would remove the employee E3 from the view because changing his department to 'D3' no longer matches the view which only contains employees in department 'D2'. To prevent this, can specify the WITH CHECK OPTION.

```
CREATE VIEW staff (Number,Name,Job,DeptNum)
AS SELECT eno,ename,title FROM emp WHERE DeptNum = 'D2'
WITH CHECK OPTION;
```

View Updatable Question

Question: Select one view definition that would be updatable.

A)
```
CREATE VIEW v AS
  SELECT DISTINCT salary FROM emp
```

B)
```
CREATE VIEW v AS
  SELECT * FROM emp WHERE eno > 'E3'
```

C)
```
CREATE VIEW v AS
  SELECT name FROM emp
```

D)
```
CREATE VIEW v AS
  SELECT eno, salary/12 FROM emp
```

Advantages and Disadvantages of Views

Advantages:

- Data independence - allows base relations to change without affecting users.
- Security - views can be used to limit access to certain data to certain users.
- Easier querying - using views can often reduce the complexity of some queries.
- Convenience/Customization - users only see the parts of the database that they have interest and access to.

Disadvantages:

- Updatable views are not always supported and are restrictive.
- Performance - views add increased overhead: during query parsing and especially if they are materialized.

Views Practice Questions

Creates views that:

- 1) Show only employees that have title '`EE`'.
- 2) List only projects that have someone working on them.
- 3) List only the employees that manage another employee.
- 4) List the department number, name, and average employee salary in the department.
- 5) Show all employees but only lists their number, name, and title.
- 6) Show all employee and `workson` information for employee '`E1`'.

Workson database:

```
emp (eno, ename, bdate, title, salary, supereno, dno)
proj (pno, pname, budget, dno)
dept (dno, dname, mgreno)
workson (eno, pno, resp, hours)
```

Conclusion

Views define virtual relations over base relations. This is useful to:

- reduce query complexity
- improve performance (especially if view is materialized)
- provide different user views of the database
- allow security to be enforced on subsets of the schema

Only certain views are updateable. This is not a limit in practice as the updates can be performed on the base relations.

Objectives

- Define views using `CREATE VIEW` from a high-level description
- Explain and illustrate the process of view resolution
- Explain when a view is updateable and argue why updating views is not possible in certain cases
- Explain what the `WITH CHECK OPTION` does for views
- List advantages and disadvantages of views


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