Distributed Database Systems

Semantic Data Control

- Involves:
  - View management
  - Security control
  - Integrity control
- Objective :
  - Ensure that authorized users perform correct operations on the database, contributing to the maintenance of the database integrity.

View Management

View – virtual relation

- generated from base relation(s) by a query
- not stored as base relations

Example :

```
CREATE VIEW    SYSAN(ENO,ENAME)
AS     SELECT  ENO,ENAME
       FROM    EMP
       WHERE   TITLE= "Syst. Anal."
```

EMP

ENO	ENAME	TITLE
E1	J. Doe	Elect. Eng
E2	M. Smith	Syst. Anal.
E3	A. Lee	Mech. Eng.
E4	J. Miller	Programmer
E5	B. Casey	Syst. Anal.
E6	L. Chu	Elect. Eng.
E7	R. Davis	Mech. Eng.
E8	J. Jones	Syst. Anal.

SYSAN

ENO	ENAME
E2	M. Smith
E5	B. Casey
E8	J. Jones

View Management

Views can be manipulated as base relations

Example :

```
SELECT ENAME, PNO, RESP
FROM   SYSAN, ASG
WHERE  SYSAN.ENO = ASG.ENO
```

Query Modification

Queries expressed on views

Queries expressed on base relations

Example :

```
SELECT ENAME, PNO, RESP
FROM   SYSAN, ASG
WHERE  SYSAN.ENO = ASG.ENO
```

```
SELECT ENAME,PNO,RESP
FROM   EMP, ASG
WHERE  EMP.ENO = ASG.ENO
AND    TITLE = "Syst. Anal."
```

ENAME	PNO	RESP
M. Smith	P1	Analyst
M. Smith	P2	Analyst
B. Casey	P3	Manager
J. Jones	P4	Manager

View Management

- To restrict access

```
CREATE VIEW   ESAME
AS     SELECT   *
       FROM     EMP E1, EMP E2
       WHERE    E1.TITLE = E2.TITLE
       AND      E1.ENO = USER();
```

Note that the user J. Doe also appears in the result. If the user who creates ESAME is an electrical engineer, as

- Query

```
SELECT *
FROM   ESAME
```

ENO	ENAME	TITLE
E1	J. Doe	Elect. Eng.
E2	L. Chu	Elect. Eng.

View Updates

- Updatable

```
CREATE VIEW    SYSAN(ENO,ENAME)
AS    SELECT   ENO,ENAME
      FROM     EMP
      WHERE    TITLE="Syst. Anal."
```

- Non-updatable

```
CREATE VIEW    EG(ENAME,RESP)
AS    SELECT   ENAME,RESP
      FROM     EMP, ASG
      WHERE    EMP.ENO=ASG.ENO
```

View Management in Distributed DBMS

- Views might be derived from fragments.
- View definition storage should be treated as database storage
- Query modification results in a distributed query
- View evaluations might be costly if base relations are distributed
  - Use materialized views

Materialized View

- Origin: snapshot in the 1980's
  - Static copy of the view, avoid view derivation for each query
  - But periodic recomputing of the view may be expensive
- Actual version of a view
  - Stored as a database relation, possibly with indices
- Used much in practice
  - DDBMS: No need to access remote, base relations
  - Data warehouse: to speed up OLAP
    - Use aggregate (SUM, COUNT, etc.) and GROUP BY

Materialized View Maintenance

- Process of updating (refreshing) the view to reflect changes to base data
  - Resembles data replication but there are differences
    - View expressions typically more complex
    - Replication configurations more general
- View maintenance policy to specify:
  - When to refresh
  - How to refresh