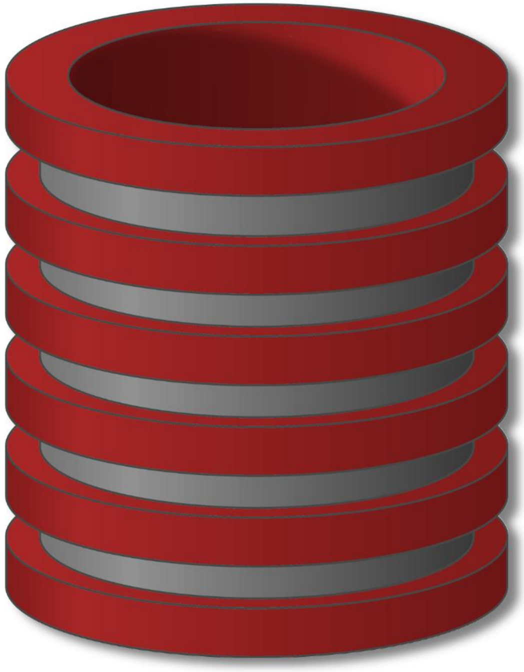

Views

Materialized Views

Jennifer Widom

Why use views?

- Hide some data from some users
- Make some queries easier / more natural
- Modularity of database access

Real applications tend to use lots and lots (and lots and lots!) of views

Why use (virtual) views?

- Hide some data from some users
- Make some queries easier / more natural
- Modularity of database access

Why use materialized views?

- Hide some data from some users
- Make some queries easier / more natural
- Modularity of database access

➢ *Improve query performance*

Virtual views

- View V = ViewQuery(R_1, R_2, …, R_n)
- Schema of V is schema of query result
- Query Q involving V, conceptually:

```
V := ViewQuery(R1,R2,…,Rn);
Evaluate Q;
```

- In reality, Q rewritten to use R_1,…,R_n instead of V

Materialized views

- View V = ViewQuery($R_1, R_2, \ldots, R_n$)
- Create table V with schema of query result
- Execute ViewQuery and put results in V
- Queries refer to V as if it's a table

But…

- V could be very large
- Modifications to $R_1, R_2, \ldots, R_n \Rightarrow$ recompute or modify V

Materialized Views

```
Create Materialized View CA-CS As
Select C.cName, S.sName
From College C, Student S, Apply A
Where C.cName = A.cName And S.sID = A.sID
And C.state = ‘CA’ And A.major = ‘CS’
```

+ Can use **CA-CS** as if it’s a table (it is!)

College

cName	state	enr

Student

sID	sName	GPA	HS

Apply

sID	cName	major	dec

Materialized Views

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– Modifications to base data invalidate view

College

cName	state	enr

Student

sID	sName	GPA	HS

Apply

sID	cName	major	dec

Materialized Views

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Create Materialized View CA-CS As
Select C.cName, S.sName
From College C, Student S, Apply A
Where C.cName = A.cName And S.sID = A.sID
And C.state = 'CA' And A.major = 'CS'
```

- Modifications to base data invalidate view

College : ~~inserts~~, ~~deletes~~, updates (cName, state)
Student : ~~inserts~~, deletes, updates (sName, sID)
Apply : inserts, deletes, updates (cName, sID, major)

General Assertions ☆

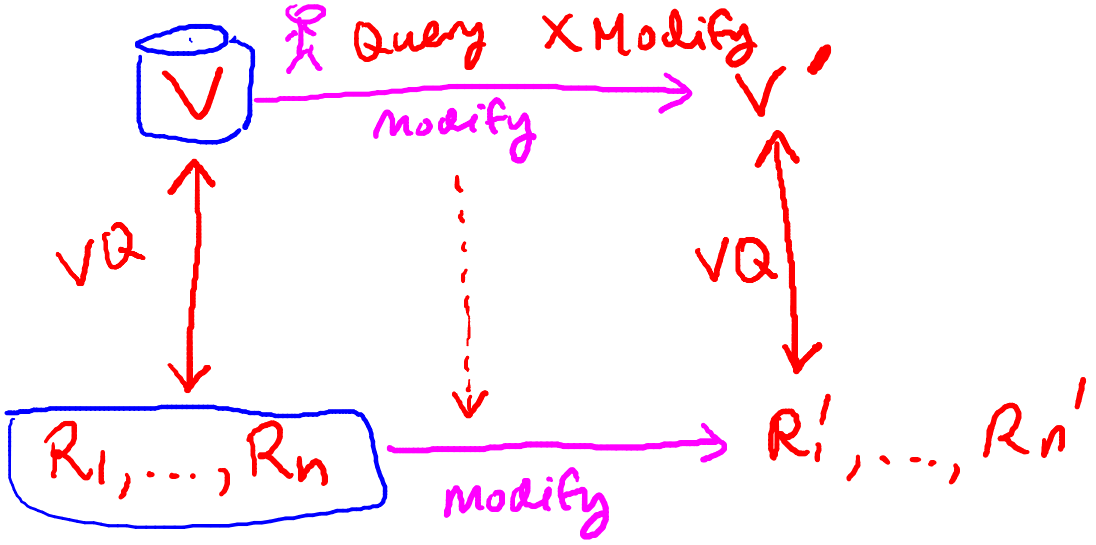
Queries over materialized views

- View *V* = ViewQuery(R_1, R_2, …, R_n)
- Create table *V* with schema of query result
- Execute ViewQuery and put results in *V*
- Queries refer to *V* as if it's a table

Modifications on materialized views?

- Good news: just update the stored table
- Bad news: base tables must stay in synch
  - Same issues as with virtual views

❖ Modifications to *V* must also modify base tables



Picking which materialized views to create

(Efficiency) benefits of a materialized view depend on:

- Size of data
- Complexity of view
- Number of queries using view
- Number of modifications affecting view
  - Also "incremental maintenance" versus full recomputation

* Query
* Update
trade off

Indexes

Automatic query rewriting to use materialized views

```
Create Materialized View CA-Apply As
Select sID, cName, major
From Apply A
Where cName In
    (Select cName From College Where state = 'CA')
```

```
Select Distinct S.sID, S.GPA
From ~~College C~~, Student S, CA-Apply A
Where ~~C.cName = A.cName And~~ S.sID = A.sID
And S.GPA > 3.5 And ~~C.state = 'CA' And~~ A.Major = 'CS'
```

$[V_1 \quad V_2 \quad \ldots \quad V_{1000} \leftarrow Q$

Why use materialized views?

- Hide some data from some users
- Make some queries easier / more natural
- Modularity of database access

➢ *Improve query performance*