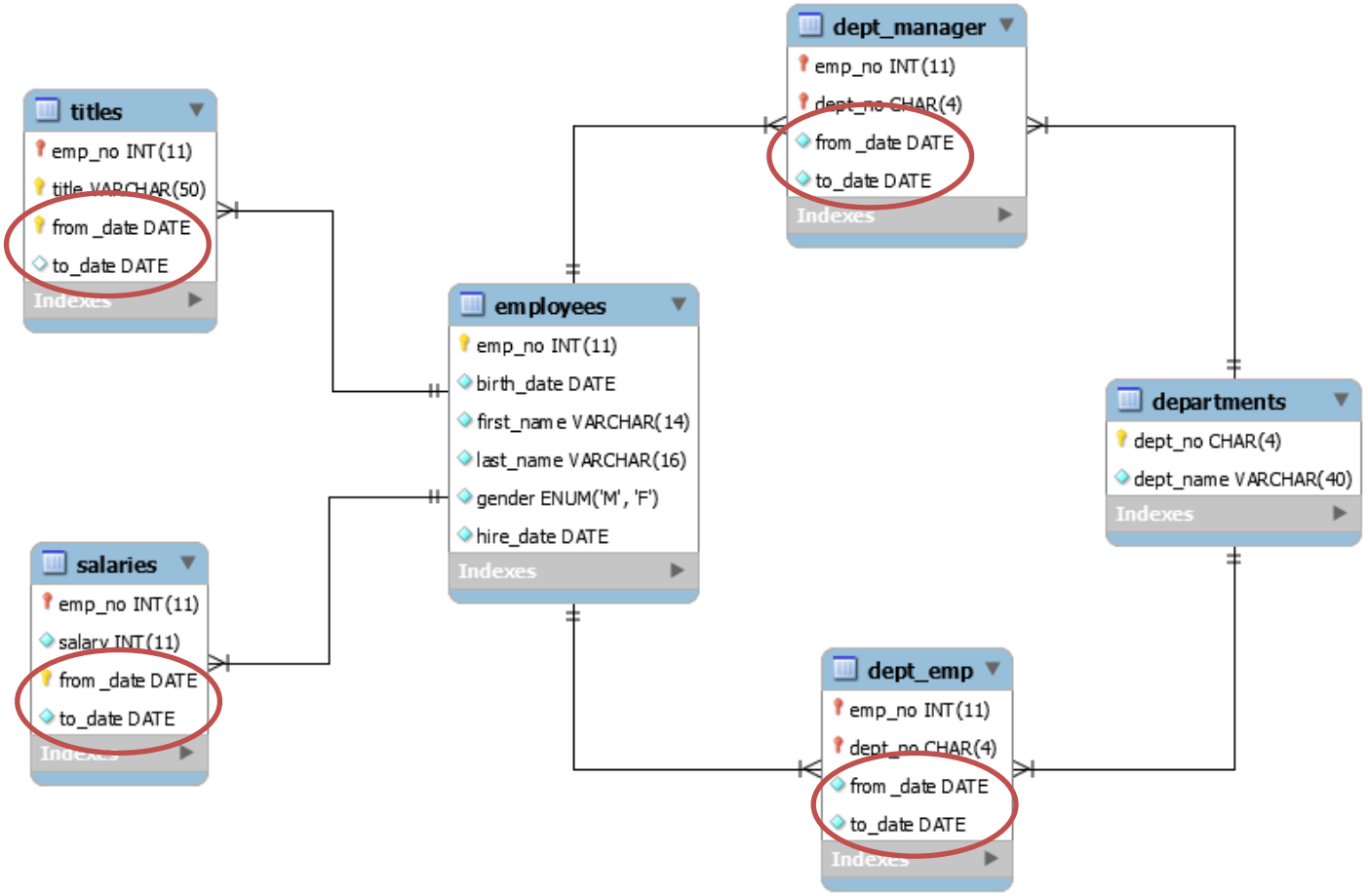
TÉCNICO LISBOA

Data Analysis and Integration

A review of SQL

Introduction

- The employees database



Introduction to Views

Views

CREATE VIEW *myview* **AS SELECT** …

- A view is a *virtual table* defined through a query
- Associates a name to a **SELECT** statement

Once created, it can be used as a *relation* but it is not the same as creating a table

Views do not have storage, they are computed, and their contents will change if the tables involved in the query change

Creating Views

Views are database objects that can be *created* and *removed*.

- Creation of a View

```
CREATE VIEW myview AS SELECT …
```

- Removal of a View

```
DROP VIEW myview
```

Creating a View: Example 1

```
CREATE VIEW account_stats_view(
      name, num_accts)
AS
SELECT customer_name, COUNT(*) AS num_accts
FROM depositor
GROUP BY customer_name;
```

```
SELECT *
FROM account_stats_view;
```

Creating a View: Example 2

```
CREATE VIEW top_employee(
   name, salary, department)
AS
SELECT name, salary, department
FROM employee
WHERE salary > 10000
```

```
SELECT name
FROM top_employee
WHERE salary >= (
    SELECT salary
    FROM top_employee)
```

A view can be queried like any regular table

Resolving Queries on Views

```
SELECT COUNT(*)
FROM top_employee
WHERE department = 'HR'
```

References to a view are replaced by its definition

```
SELECT COUNT(*)
FROM (SELECT name, salary, department
   FROM employee
   WHERE salary > 10000)
WHERE department = 'HR'
```

The technique for evaluating view queries is known as

View Expansion

Views and Logical Independence

Security

Suppose App A works with *VIP customers* and
App B works with *Regular Customers*

```
CREATE VIEW V1_vip_customer
AS
SELECT
FROM cu
WHERE 1
   SELE
   FROM
      O
   AND
```

```
CREATE VIEW V2_regular
SELECT customer_name, customer_ci
FROM customer c
WHERE 1000000 > (
   SELECT SUM(balance)
   FROM account a INNER JOIN depositor d
      ON a.account_number =
      d.account_number
   AND d.customer_name = c.customer_name
```

Both V1 and V2 views can be created based on the same base tables

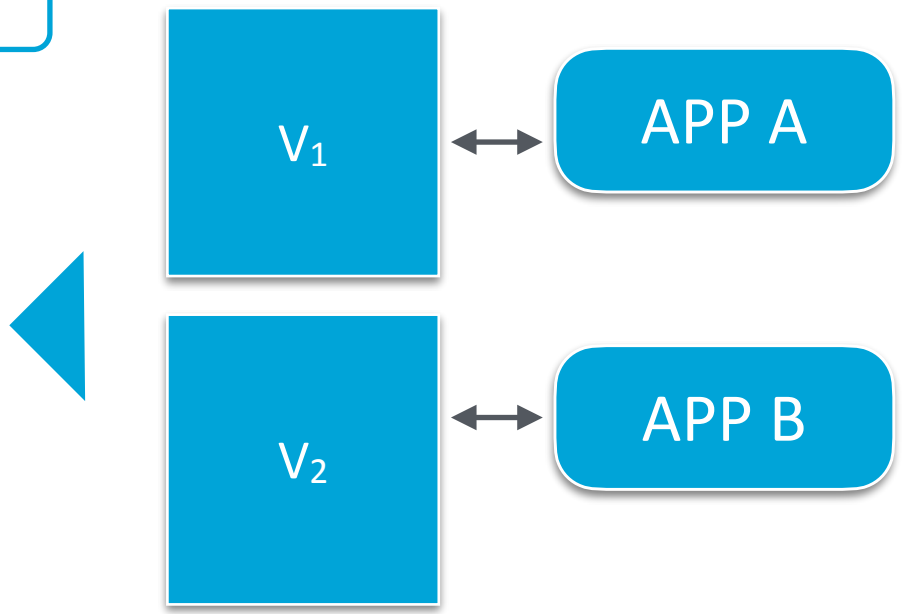
Views can partition a table horizontally or vertically and give applications the illusion that they are dealing with distinct tables

Security

No user/app besides the DB administrator can ever see the account records

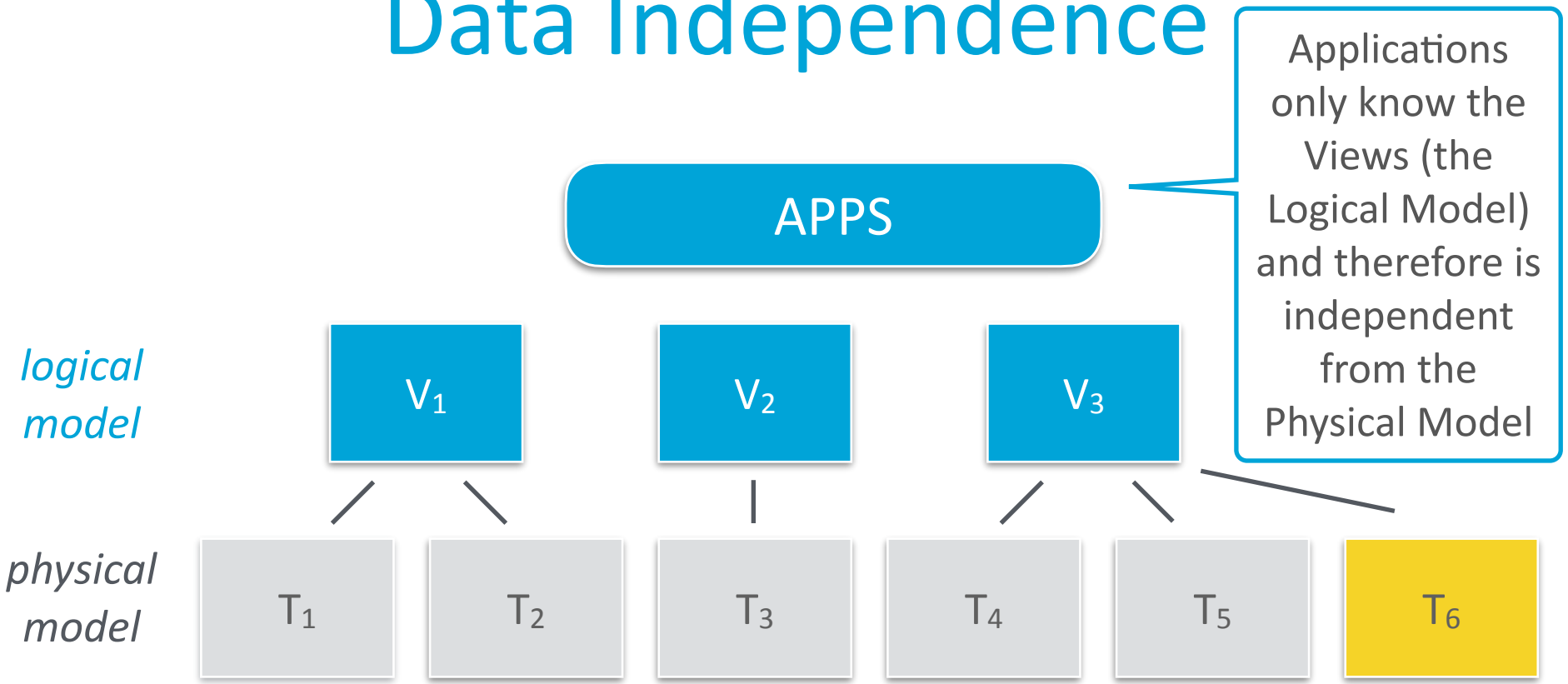
APP A only sees V1 and the 'VIP' records

account_number	branch_name	balance
A-101	Downtown	500.0000
A-215	Metro	600.0000
A-102	Uptown	700.0000
A-305	Round Hill	800.0000
A-201	Uptown	900.0000
A-222	Central	550.0000
A-217	University	650.0000
A-333	Central	750.0000
A-444	Downtown	850.0000



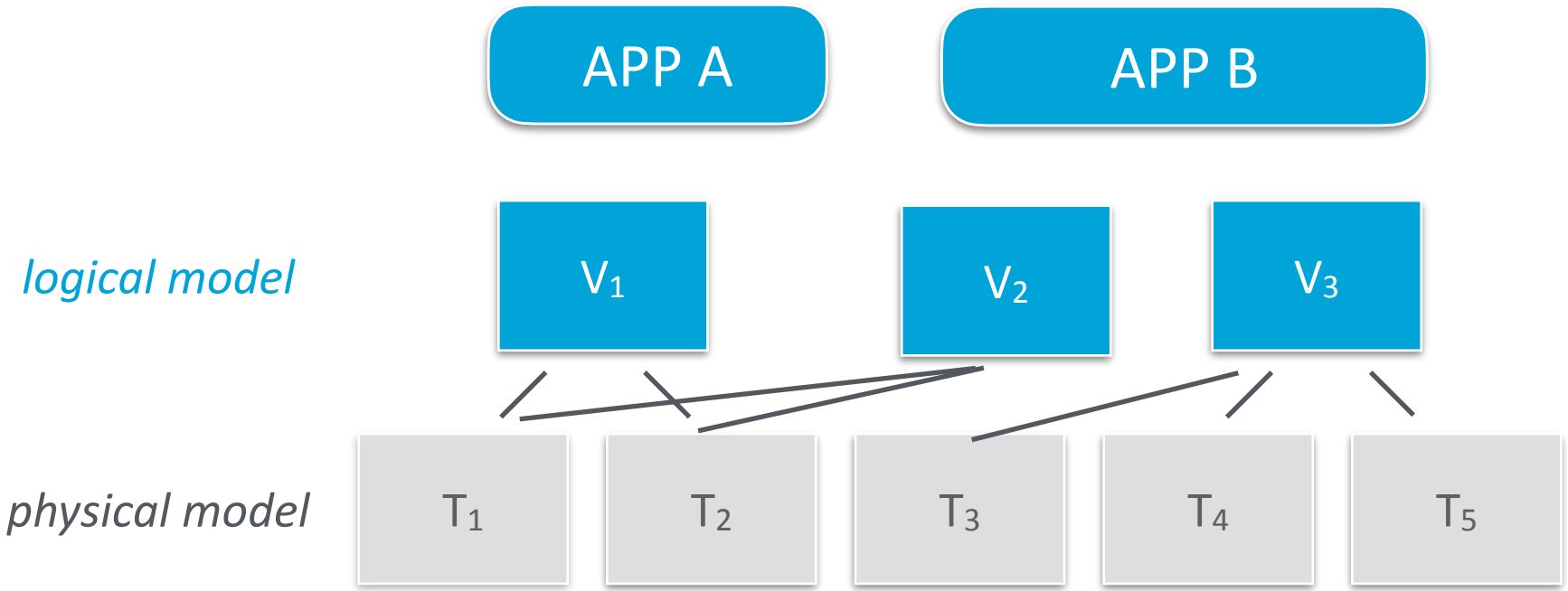
APP B only sees V2 and the 'Regular' records

Data Independence



- **Views** map data from tables the *physical model* to a new *logical model*
- **Views** support logical independence from the *physical model*

Security



Views are useful for security context: The DBA can create views and grant them access to a group of users (or applications).

Views

- **curr_salaries(emp_no, salary)**
  - a **view** that returns the current salary of each employee
- **curr_dept_emp(emp_no, dept_no)**
  - a **view** that returns the current department of each employee
- **curr_dept_manager(emp_no, dept_no)**
  - a **view** that returns the current manager of each department
- **curr_titles(emp_no, title)**
  - a **view** that returns the current title of each employee

SQL Views

- curr_salaries(emp_no, salary)
  - a **view** that returns the current salary of each employee

```
create or replace view curr_salaries(emp_no, salary) as
    select emp_no, salary
    from salaries
    where from_date <= current_date and to_date >= current_date;

select * from curr_salaries limit 10;
```

```
+--------+--------+
| emp_no | salary |
+--------+--------+
|  10721 |  44812 |
|  11260 |  52435 |
|  11371 |  81461 |
|  11693 | 101179 |
|  13816 |  76104 |
|  14007 | 105453 |
|  14083 |  71350 |
|  14791 |  49249 |
|  17698 |  91443 |
|  17739 |  91836 |
+--------+--------+
10 rows in set (0.00 sec)
```

SQL Views

- curr_dept_emp(emp_no, dept_no)
  - a **view** that returns the current department of each employee

```
create or replace view curr_dept_emp(emp_no, dept_no) as
    select emp_no, dept_no
    from dept_emp
    where from_date <= current_date and to_date >= current_date;

select * from curr_dept_emp limit 10;
```

```
+--------+---------+
| emp_no | dept_no |
+--------+---------+
|  10721 | d009    |
|  11260 | d009    |
|  11371 | d005    |
|  11693 | d005    |
|  13816 | d005    |
|  14007 | d002    |
|  14083 | d004    |
|  14791 | d005    |
|  17698 | d005    |
|  17739 | d005    |
+--------+---------+
10 rows in set (0.00 sec)
```

SQL Views

- curr_dept_manager(emp_no, dept_no)
  - a **view** that returns the current manager of each department

```
create or replace view curr_dept_manager(emp_no, dept_no) as
    select emp_no, dept_no
    from dept_manager
    where from_date <= current_date and to_date >= current_date;

select * from curr_dept_manager;
```

```
+--------+---------+
| emp_no | dept_no |
+--------+---------+
| 110039 | d001    |
| 110114 | d002    |
| 110228 | d003    |
| 110420 | d004    |
| 110567 | d005    |
| 110854 | d006    |
| 111133 | d007    |
| 111534 | d008    |
| 111939 | d009    |
+--------+---------+
9 rows in set (0.00 sec)
```

SQL Views

- curr_titles(emp_no, title)
  - a **view** that returns the current title of each employee

```
create or replace view curr_titles(emp_no, title) as
    select emp_no, title
    from titles
    where from_date <= current_date and to_date >= current_date;

select * from curr_titles limit 10;
```

```
+--------+--------------------+
| emp_no | title              |
+--------+--------------------+
|  10721 | Staff              |
|  11260 | Staff              |
|  11371 | Senior Engineer    |
|  11693 | Senior Engineer    |
|  13816 | Senior Engineer    |
|  14007 | Senior Staff       |
|  14083 | Senior Engineer    |
|  14791 | Assistant Engineer |
|  17698 | Senior Engineer    |
|  17739 | Technique Leader   |
+--------+--------------------+
10 rows in set (0.00 sec)
```

New schema (with views)

- old schema

  employees(emp_no, birth_date, first_name, last_name, gender, hire_date)
  departments(dept_no, dept_name)
  dept_emp(emp_no, dept_no, from_date, to_date)
  dept_manager(emp_no, dept_no, from_date, to_date)
  salaries(emp_no, salary, from_date, to_date)
  titles(emp_no, title, from_date, to_date)

- new schema

  employees(emp_no, birth_date, first_name, last_name, gender, hire_date)
  departments(dept_no, dept_name)
  curr_dept_emp(emp_no, dept_no)
  curr_dept_manager(emp_no, dept_no)
  curr_salaries(emp_no, salary)
  curr_titles(emp_no, title)

Queries over views

- Simple query

```
select emp_no, salary
from curr_salaries
where salary > 80000
limit 10;
```

```
+--------+--------+
| emp_no | salary |
+--------+--------+
|  11371 |  81461 |
|  11693 | 101179 |
|  14007 | 105453 |
|  17698 |  91443 |
|  17739 |  91836 |
|  17890 |  80046 |
|  25730 |  82887 |
|  25949 |  80946 |
|  26002 |  94825 |
|  30851 | 104788 |
+--------+--------+
10 rows in set (0.00 sec)
```

Queries over views

- salaries and employees

```
select a.emp_no, a.salary, b.first_name, b.last_name
from curr_salaries as a, employees as b
where a.emp_no = b.emp_no
limit 10;
```

```
+--------+--------+------------+-------------+
| emp_no | salary | first_name | last_name   |
+--------+--------+------------+-------------+
|  10721 |  44812 | Bernd      | Redmiles    |
|  11260 |  52435 | Ingemar    | Schade      |
|  11371 |  81461 | Tadahiko   | Masamoto    |
|  11693 | 101179 | Hideo      | Coorg       |
|  13816 |  76104 | Miquel     | Maksimenko  |
|  14007 | 105453 | Shiv       | Jervis      |
|  14083 |  71350 | Sashi      | Figueira    |
|  14791 |  49249 | Magy       | Garrabrants |
|  17698 |  91443 | Kazuhito   | Larfeldt    |
|  17739 |  91836 | Satoru     | Chaudhury   |
+--------+--------+------------+-------------+
10 rows in set (0.00 sec)
```

Queries over views

- employees and departments

```
select a.first_name, a.last_name, c.dept_name
from employees as a,
        curr_dept_emp as b,
        departments as c
where a.emp_no = b.emp_no and b.dept_no = c.dept_no
limit 10;
```

```
+------------+-------------+------------------+
| first_name | last_name   | dept_name        |
+------------+-------------+------------------+
| Bernd      | Redmiles    | Customer Service |
| Ingemar    | Schade      | Customer Service |
| Sandeepan  | McClurg     | Customer Service |
| Mohit      | Simkin      | Customer Service |
| Patricia   | Kropatsch   | Customer Service |
| Monique    | Werthner    | Customer Service |
| Abdelghani | Keustermans | Customer Service |
| Tremaine   | Attimonelli | Customer Service |
| Gritta     | Gischer     | Customer Service |
| Harngdar   | Herber      | Customer Service |
+------------+-------------+------------------+
10 rows in set (0.00 sec)
```

Queries over views

- number of employees in each department

```
select a.dept_no, b.dept_name, count(a.emp_no) as count_emp_no
from curr_dept_emp as a,
        departments as b
where a.dept_no = b.dept_no
group by a.dept_no, b.dept_name
order by count_emp_no desc;
```

```
+---------+--------------------+--------------+
| dept_no | dept_name          | count_emp_no |
+---------+--------------------+--------------+
| d005    | Development        |           62 |
| d004    | Production         |           44 |
| d007    | Sales              |           42 |
| d009    | Customer Service   |           29 |
| d006    | Quality Management |           18 |
| d002    | Finance            |           18 |
| d001    | Marketing          |           15 |
| d008    | Research           |           14 |
| d003    | Human Resources    |           10 |
+---------+--------------------+--------------+
9 rows in set (0.00 sec)
```

Queries over views

- sum of salaries by department

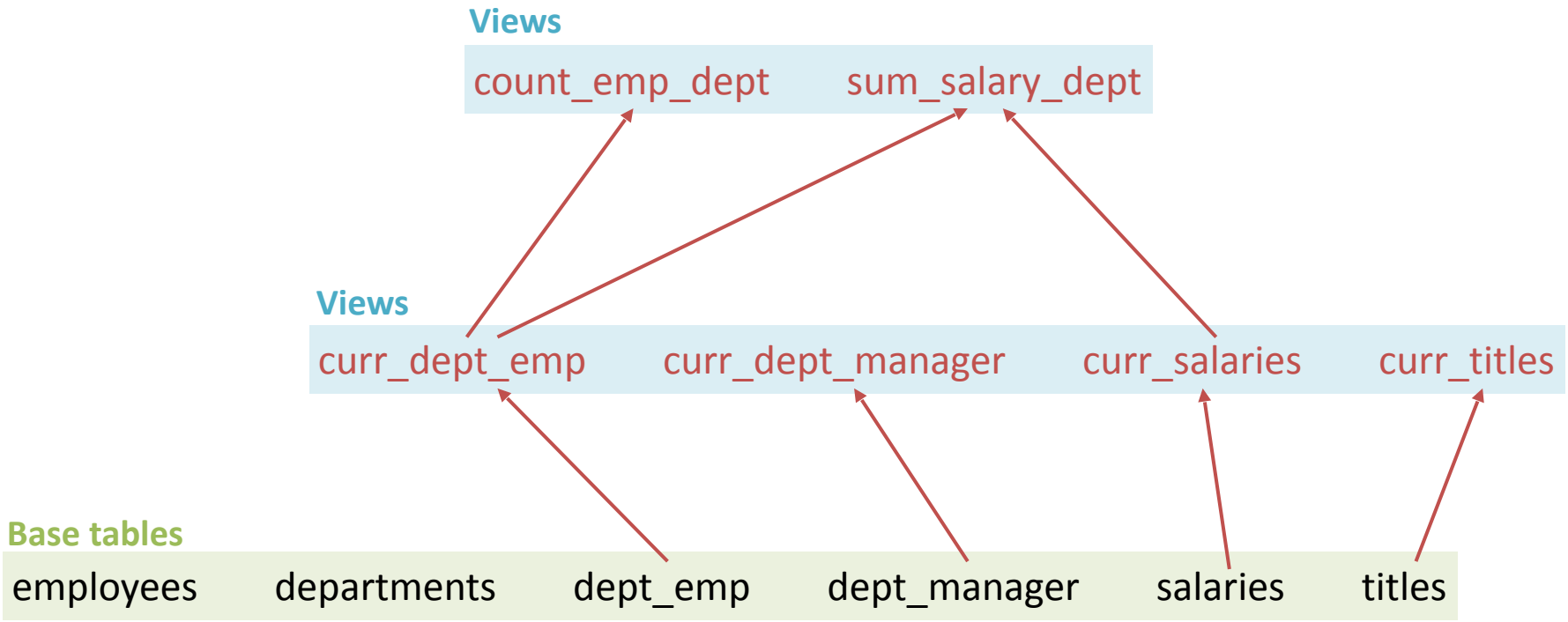
```
select b.dept_no, c.dept_name, sum(a.salary) as sum_salary
from curr_salaries as a,
        curr_dept_emp as b,
        departments as c
where a.emp_no = b.emp_no
   and b.dept_no = c.dept_no
group by b.dept_no, c.dept_name
order by sum_salary desc;
```

```
+---------+--------------------+------------+
| dept_no | dept_name          | sum_salary |
+---------+--------------------+------------+
| d005    | Development        |    4434974 |
| d007    | Sales              |    3715959 |
| d004    | Production         |    2928341 |
| d009    | Customer Service   |    1914195 |
| d002    | Finance            |    1492870 |
| d001    | Marketing          |    1249477 |
| d006    | Quality Management |    1212103 |
| d008    | Research           |    1064935 |
| d003    | Human Resources    |     643182 |
+---------+--------------------+------------+
9 rows in set (0.01 sec)
```

Views over views

Views over views

- Higher schemas



Views over views

- count_emp_dept(dept_no, count_emp)
  - a **view** to show the number of employees in each department

- sum_salary_dept(dept_no, sum_salary)
  - a **view** to show the sum of salaries by department

Views over views

- count_emp_dept(dept_no, count_emp)
  - a **view** to show the number of employees in each department

```
create or replace view count_emp_dept(dept_no, count_emp) as
    select dept_no, count(emp_no) as count_emp
    from curr_dept_emp
    group by dept_no;
```

```
select * from count_emp_dept;
```

```
+---------+-----------+
| dept_no | count_emp |
+---------+-----------+
| d001    |        15 |
| d002    |        18 |
| d003    |        10 |
| d004    |        44 |
| d005    |        62 |
| d006    |        18 |
| d007    |        42 |
| d008    |        14 |
| d009    |        29 |
+---------+-----------+
9 rows in set (0.00 sec)
```

Views over views

- sum_salary_dept(dept_no, sum_salary)
  - a **view** to show the Sum of salaries by department

```
create or replace view sum_salary_dept(dept_no, sum_salary) as
    select b.dept_no, sum(a.salary) as sum_salary
    from curr_salaries as a, curr_dept_emp as b
    where a.emp_no = b.emp_no
    group by b.dept_no;
```

```
select * from sum_salary_dept;
```

```
+---------+------------+
| dept_no | sum_salary |
+---------+------------+
| d001    |    1249477 |
| d002    |    1492870 |
| d003    |     643182 |
| d004    |    2928341 |
| d005    |    4434974 |
| d006    |    1212103 |
| d007    |    3715959 |
| d008    |    1064935 |
| d009    |    1914195 |
+---------+------------+
9 rows in set (0.00 sec)
```

View expansion / unfolding

Query unfolding (curr_salaries)

```
select emp_no, salary
from curr_salaries
where salary > 80000
limit 10;
```

```
create or replace view curr_salaries(emp_no, salary) as
    select emp_no, salary
    from salaries
    where from_date <= current_date and to_date >= current_date;
```

```
select emp_no, salary
from (select emp_no, salary
        from salaries
        where from_date <= current_date
          and to_date >= current_date) as a
where salary > 80000
limit 10;
```

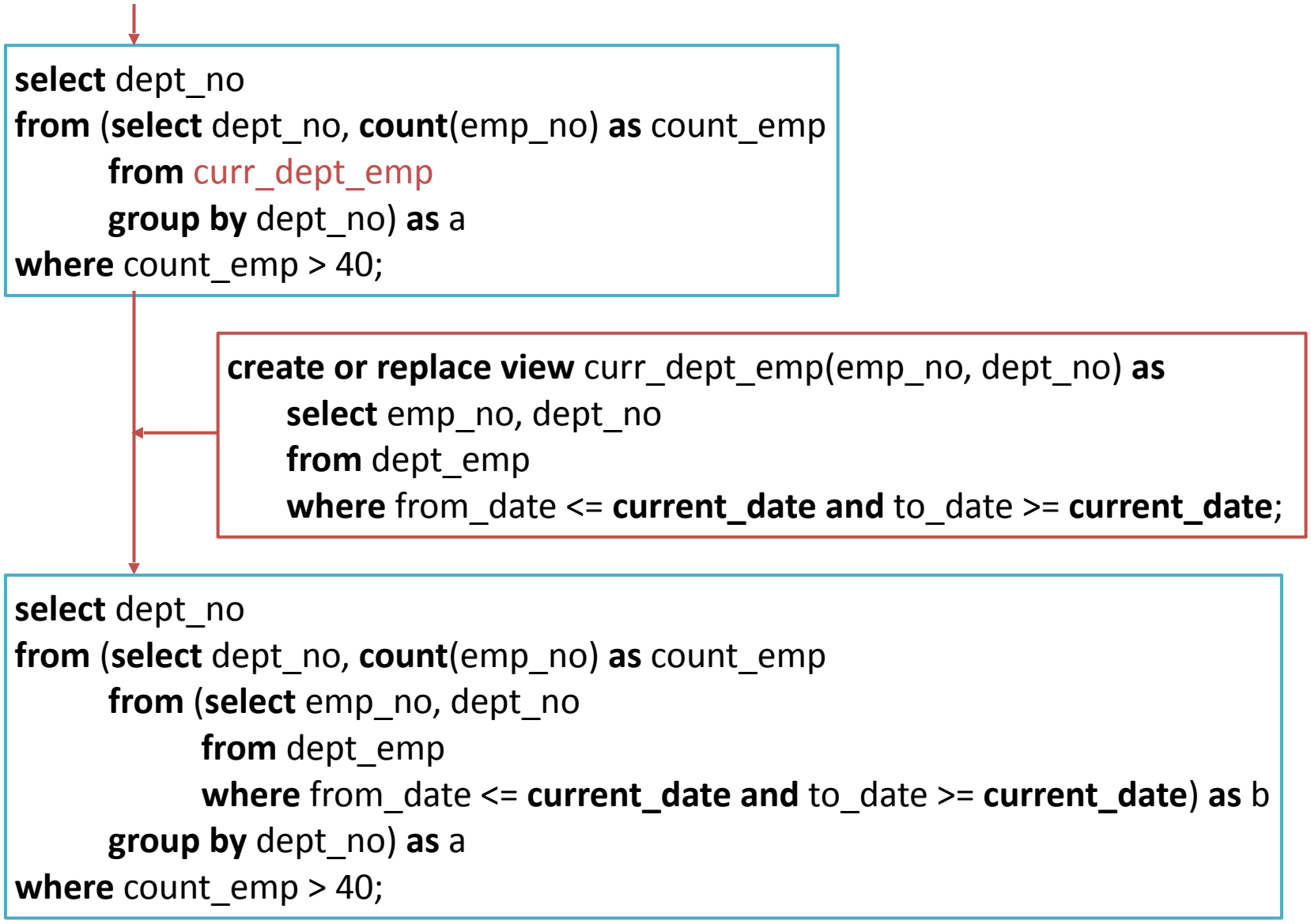
Query unfolding (count_emp_dept)

```
select dept_no
from count_emp_dept
where count_emp > 40;
```

```
create or replace view count_emp_dept(dept_no, count_emp) as
    select dept_no, count(emp_no) as count_emp
    from curr_dept_emp
    group by dept_no;
```

```
select dept_no
from (select dept_no, count(emp_no) as count_emp
      from curr_dept_emp
      group by dept_no) as a
where count_emp > 40;
```

Query unfolding (count_emp_dept)



Query unfolding (count_emp_dept)

- Note that

```
select dept_no
from (select dept_no, count(emp_no) as count_emp
        from (select emp_no, dept_no
                from dept_emp
                where from_date <= current_date and to_date >= current_date) as b
        group by dept_no) as a
where count_emp > 40;
```

could be **re-written** more simply as:

```
select dept_no
from dept_emp
where from_date <= current_date and to_date >= current_date
group by dept_no
having count(emp_no) > 40;
```

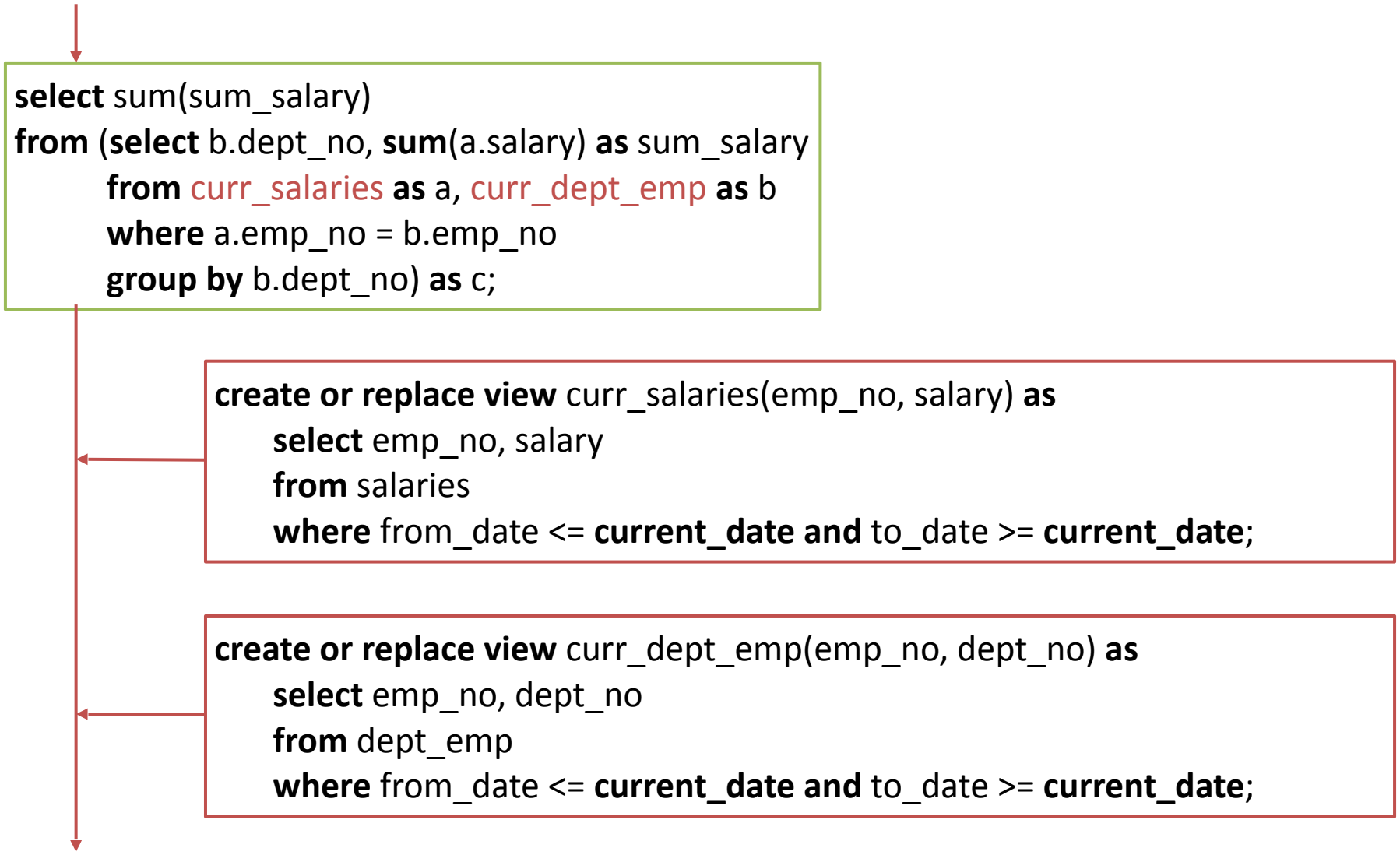
Query unfolding (sum_salary_dept)

```
select sum(sum_salary)
from sum_salary_dept;
```

```
create or replace view sum_salary_dept(dept_no, sum_salary) as
    select b.dept_no, sum(a.salary) as sum_salary
    from curr_salaries as a, curr_dept_emp as b
    where a.emp_no = b.emp_no
    group by b.dept_no;
```

```
select sum(sum_salary)
from (select b.dept_no, sum(a.salary) as sum_salary
      from curr_salaries as a, curr_dept_emp as b
      where a.emp_no = b.emp_no
      group by b.dept_no) as c;
```

Query unfolding (sum_salary_dept)



Query unfolding (sum_salary_dept)


```
select sum(sum_salary)
from (select b.dept_no, sum(a.salary) as sum_salary
        from (select emp_no, salary
                from salaries
                where from_date <= current_date and to_date >= current_date) as a,
               (select emp_no, dept_no
                from dept_emp
                where from_date <= current_date and to_date >= current_date) as b
        where a.emp_no = b.emp_no
        group by b.dept_no) as c;
```

```
+------------------+
| sum(sum_salary)  |
+------------------+
|         18656036 |
+------------------+
1 row in set (0.01 sec)
```

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