Query Processing for Non-traditional Applications

CS848 Spring 2013

Cheriton School of CS

The ACME PAYROLL System: A Case Study

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Example of PAYROLL metadata specified by APS.

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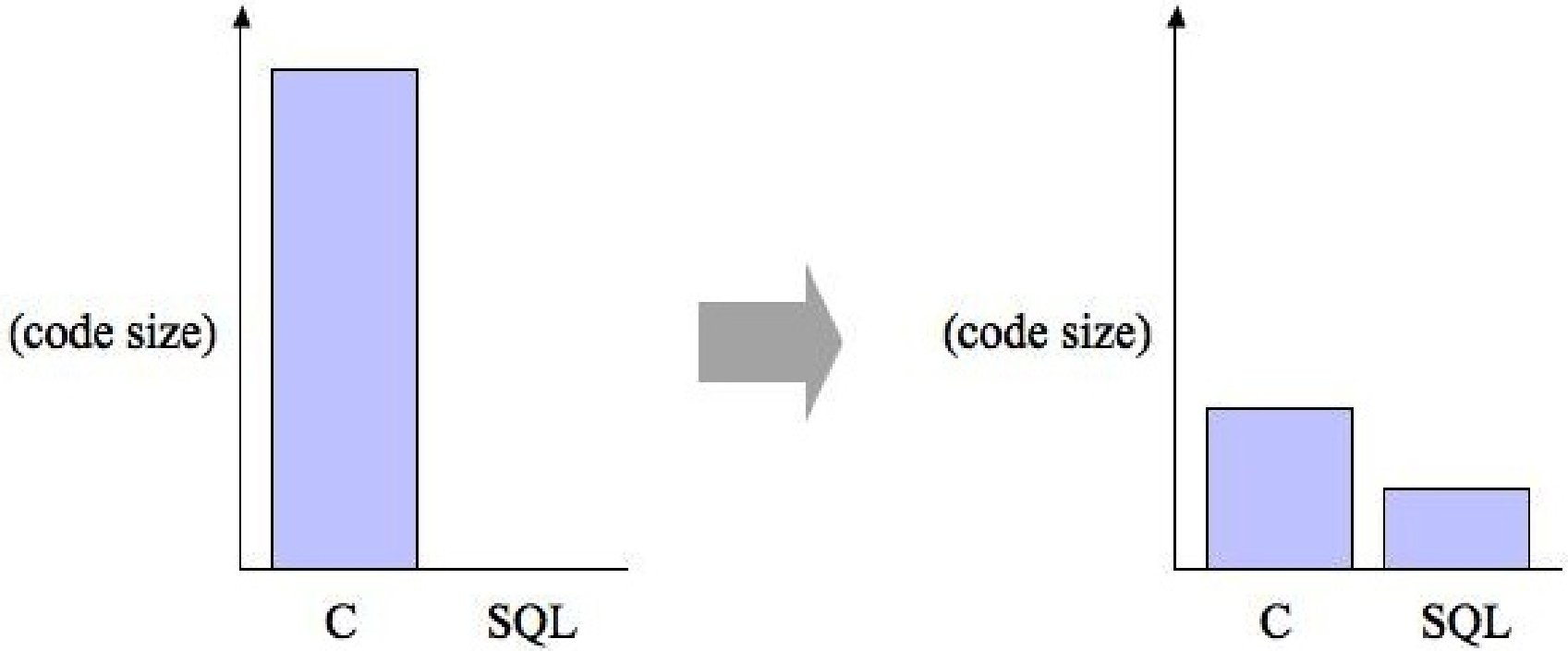

Reduces time needed by APS to create PAYROLL.

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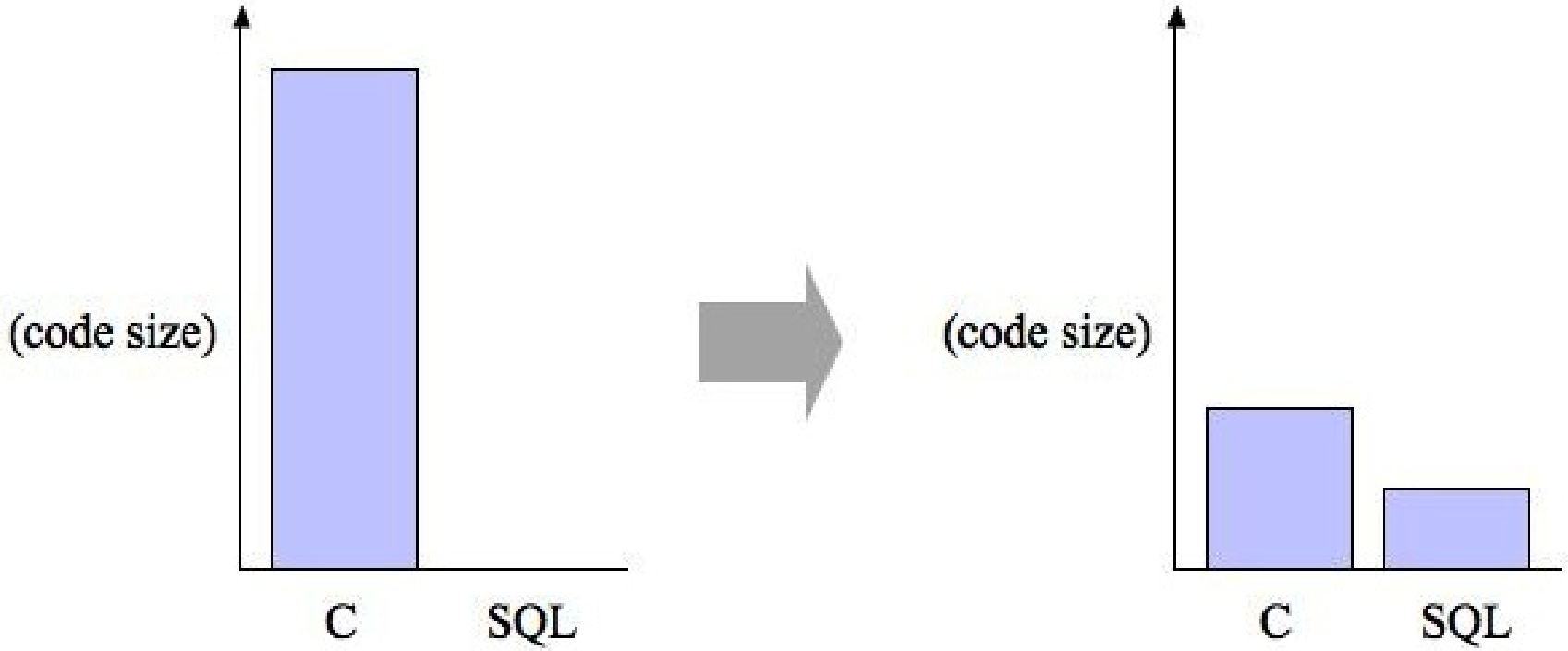
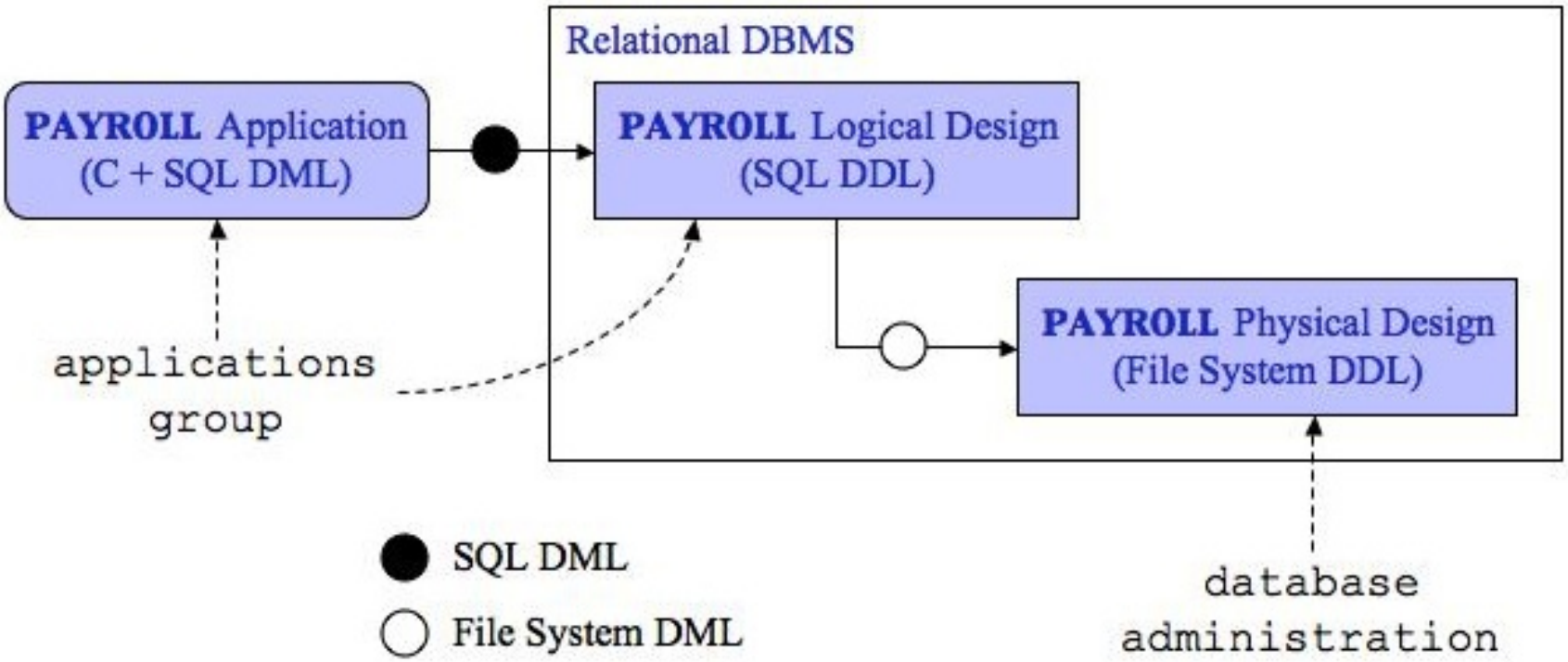


Reduces time needed by APS to create PAYROLL.

Reduces time needed for new APS personnel to learn about `payroll`.

ACME PAYROLL System: Architecture



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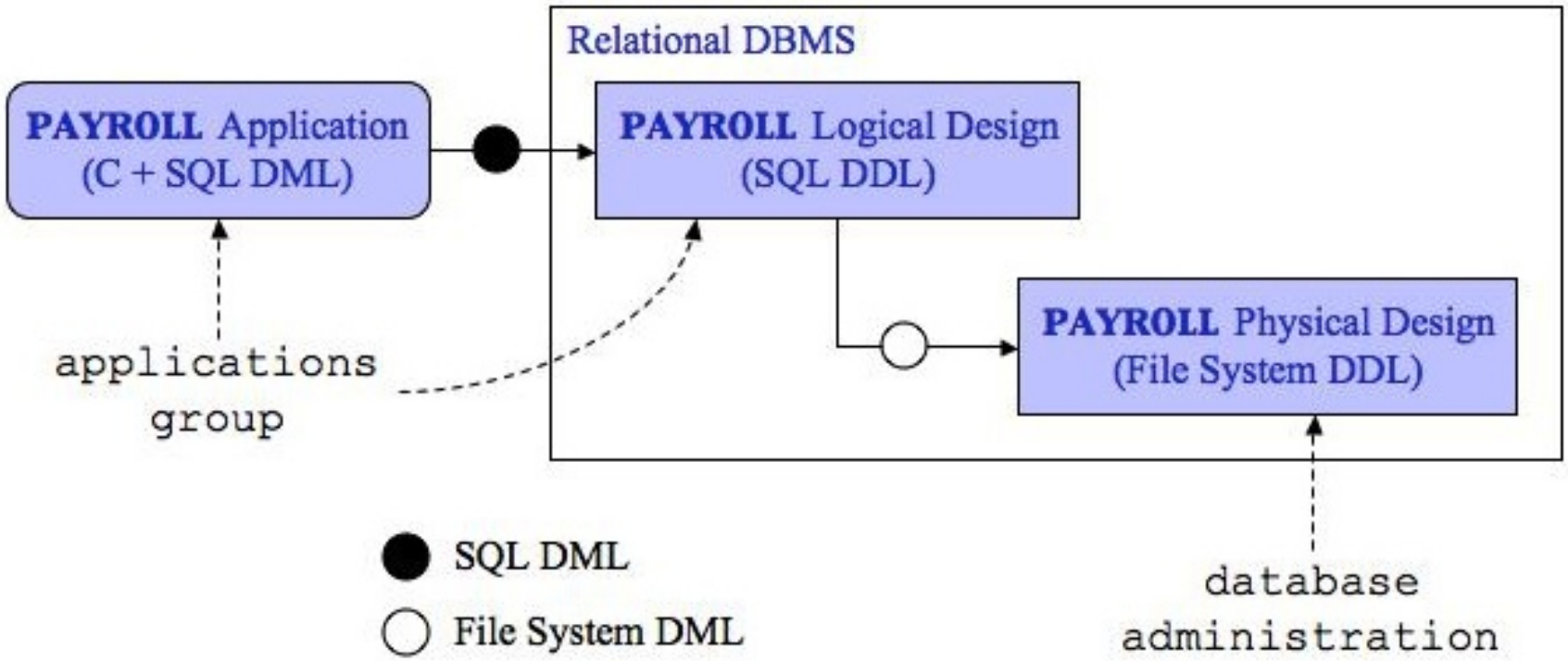

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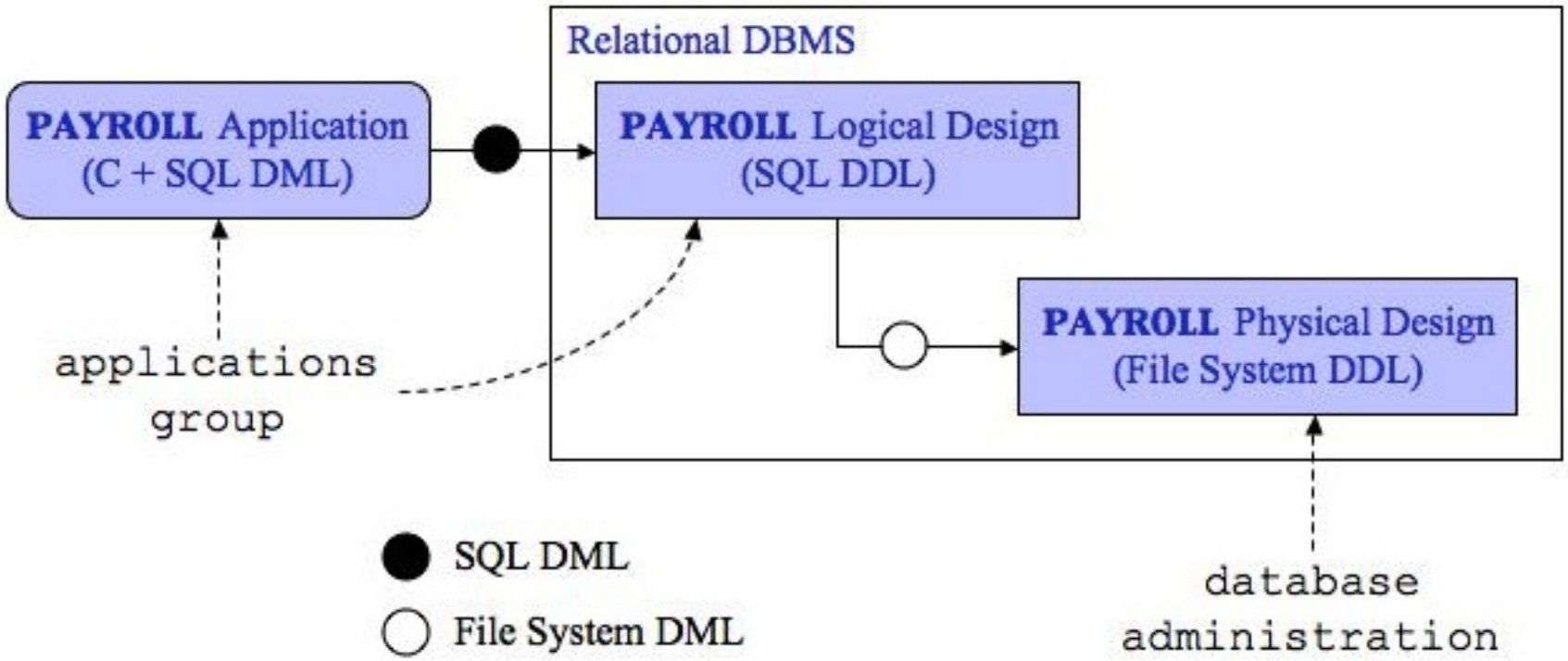

Metadata is expressed in a *data definition language* (DDL).

Code/specifications that access and update data is expressed in a *data manipulation language* (DML).

ACME PAYROLL System: Physical Design

A *physical design* for PAYROLL selected by DBA.

8. There is a file of records called `emp-file`.
9. There are record fields `emp-num`, `emp-name` and `emp-salary`.
10. Each `emp-file` record has the fields `emp-num`, `emp-name` and `emp-salary`.
11. File `emp-file` is organized as a B-tree data structure that supports an `emp-lookup` operation, given a value for attribute `enumber`.
12. Records in file `emp-file` correspond one-to-one to `employee` entities.
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ACME PAYROLL System: Queries and Query Plans

A PAYROLL *user query* specified by APS.

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The query is *physically data independent*.

The plan is *physically data dependent*.

The plan is *executable*.

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ACME LINUX-INFO System: Data and Metadata

Example of LINUX-INFO data important to APS.

1. process `gcc` is running
2. `gcc`'s process number is 1234.
3. the user running `gcc` is 145.
4. `gcc` uses file "foo.c"

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3. the user running `gcc` is 145.
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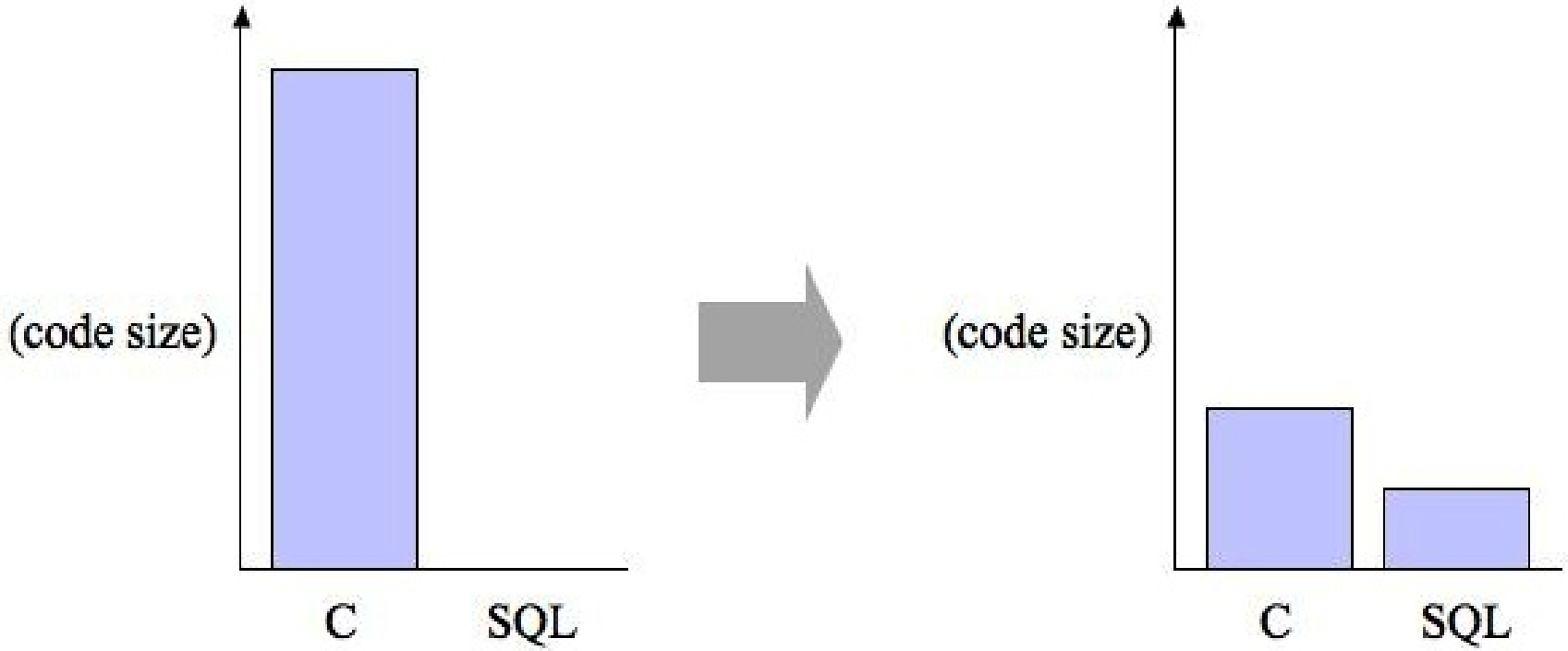
Example of LINUX-INFO metadata specified by APS.

4. There entities called `process` and `file`.
5. There are attributes called `pno`, `pname`, `uname`, and `fname`.
6. Each process entity has attributes `pno`, `pname` and `uname`.
7. Each file entity has attribute `fname`.
8. Processes are identified by their `pno`.
9. Files are identified by their `fname`.
10. There is a relationship `uses` between processes and files.

ACME LINUX-INFO System: Motivation



Reduces time needed by APS to create LINUX-INFO. Reduces time needed for new APS personnel to learn about LINUX.

The LINUX System: Physical Design

A *physical design* for LINUX (selected by Linus Torvalds).

8. There are process records called `task-struct`.
9. Each `task-struct` record has record fields `pid`, `uid`, `comm`, and `file-struct`.
10. All `task-struct`s is organized as a tree data structure.
11. The `task-struct` records correspond one-to-one to `process` entities.
12. Record fields in `task-struct` encode the corresponding attribute values for `process` entities, for example, `pid` encodes an `pno`, etc.
13. Similarly, `fs`s correspond appropriately to (open) `file` entities.
14. `file-struct` field of `task-struct` is an array of `fd`s; an entry in this array indicates that the `process` corresponding to this `task-struct` is using the `file` represented by the `fd` record in the array.

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15. Scan tree of `task-struct`s, for each check if its `uid` attribute is 145 and, if so scan the `file-struct array` in the `task-struct` and print out the names of files described by non-NULL file descriptors (`fd`).

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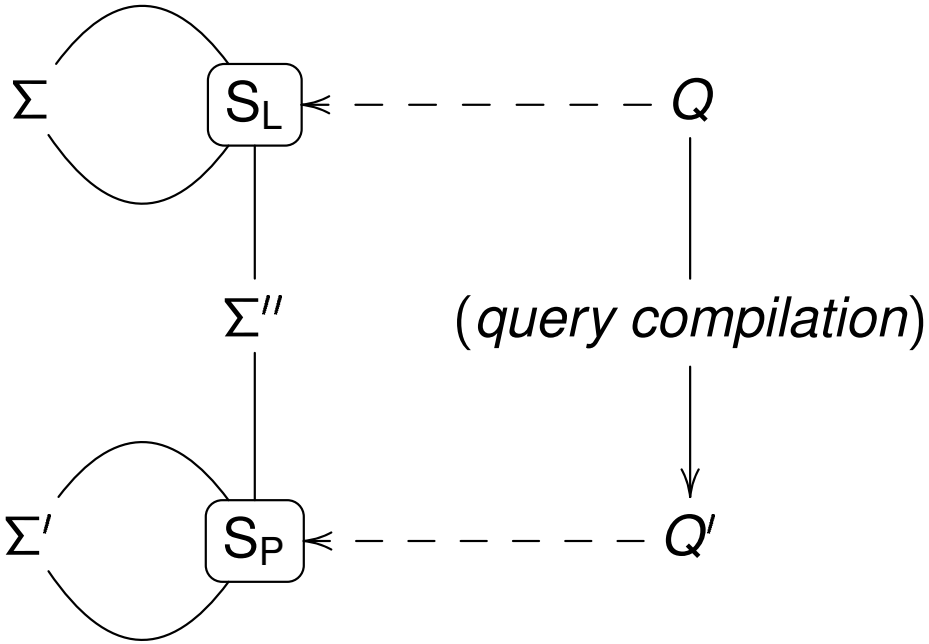
Question:

Does the *physical design* allow APS to list all files known to the Linux system?

Physical Design and Query Compilation: Overview

$$\Sigma = (\Sigma \cup \Sigma' \cup \Sigma'')$$



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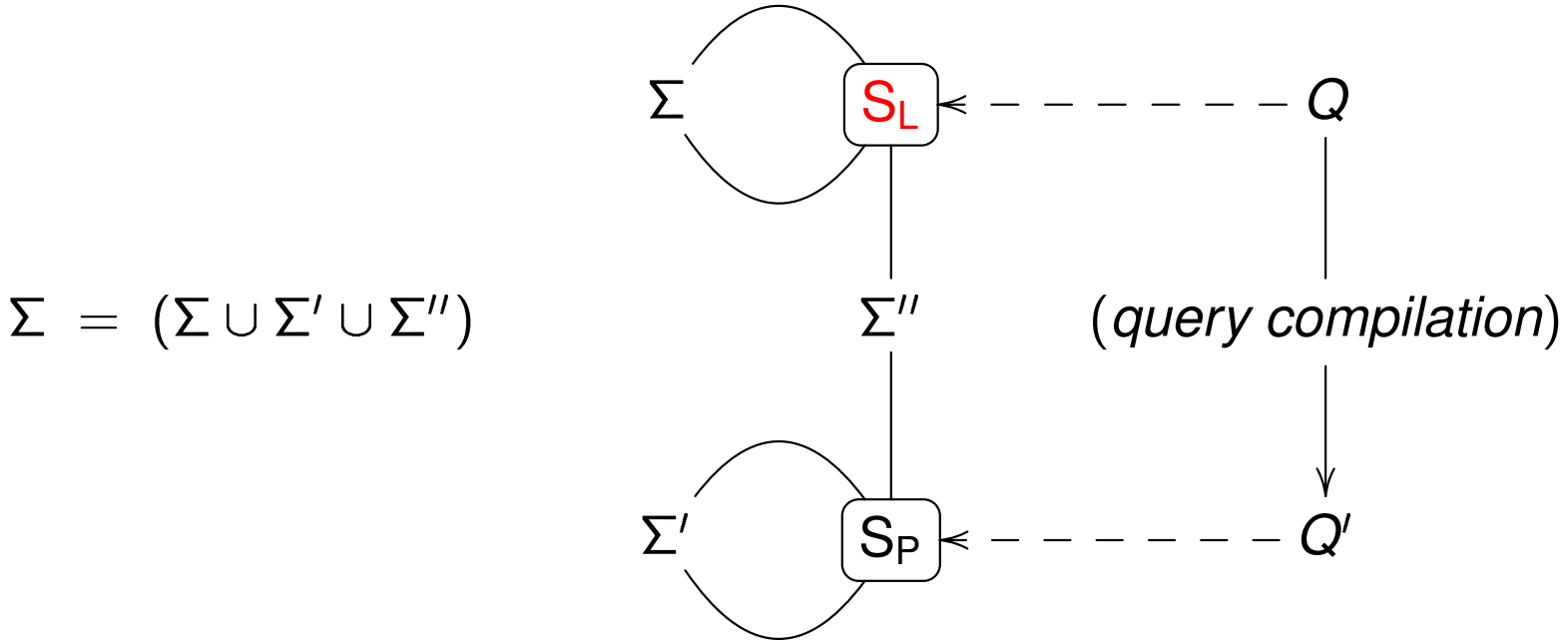

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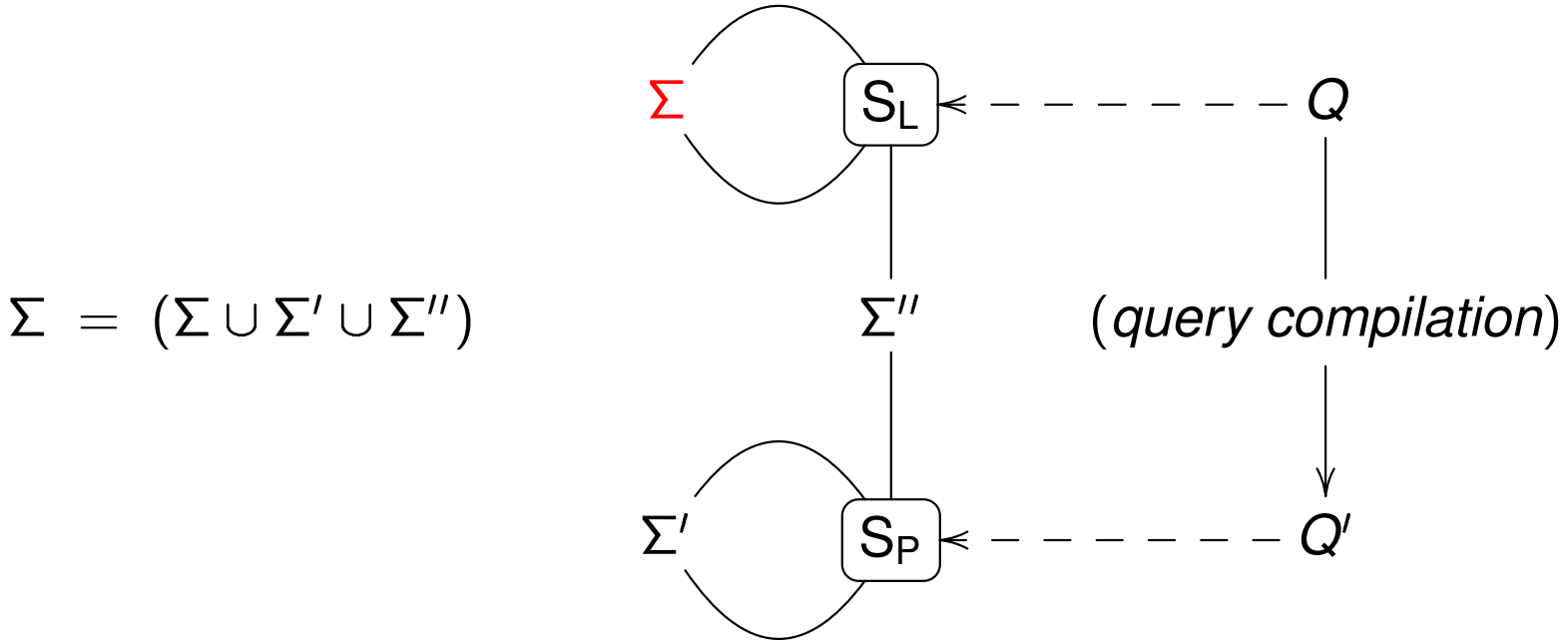

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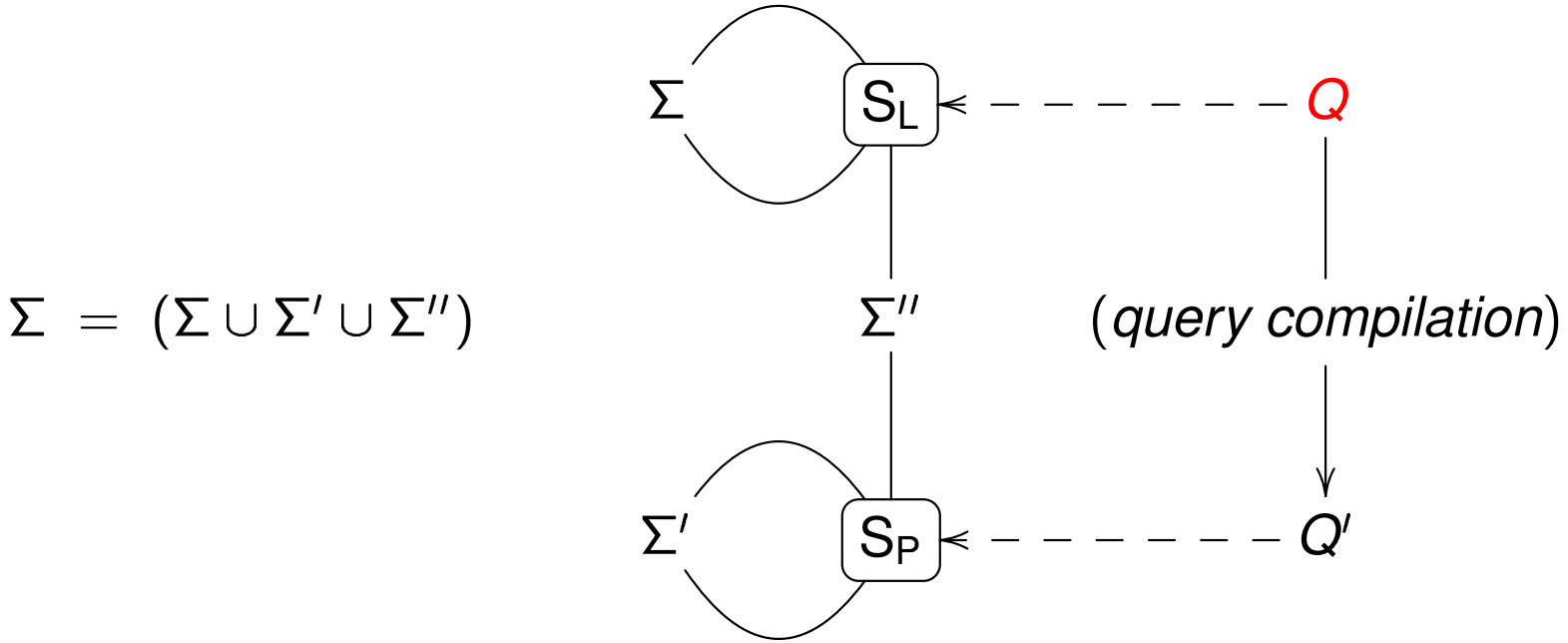

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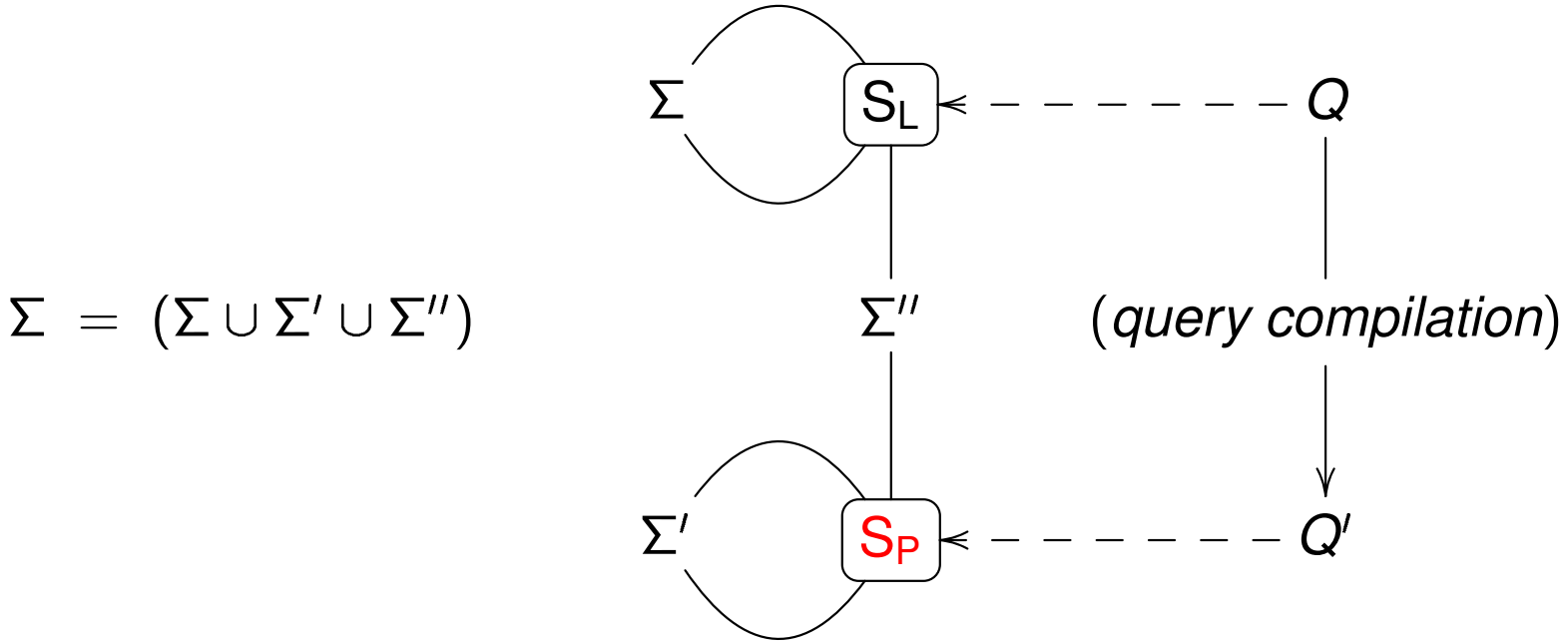

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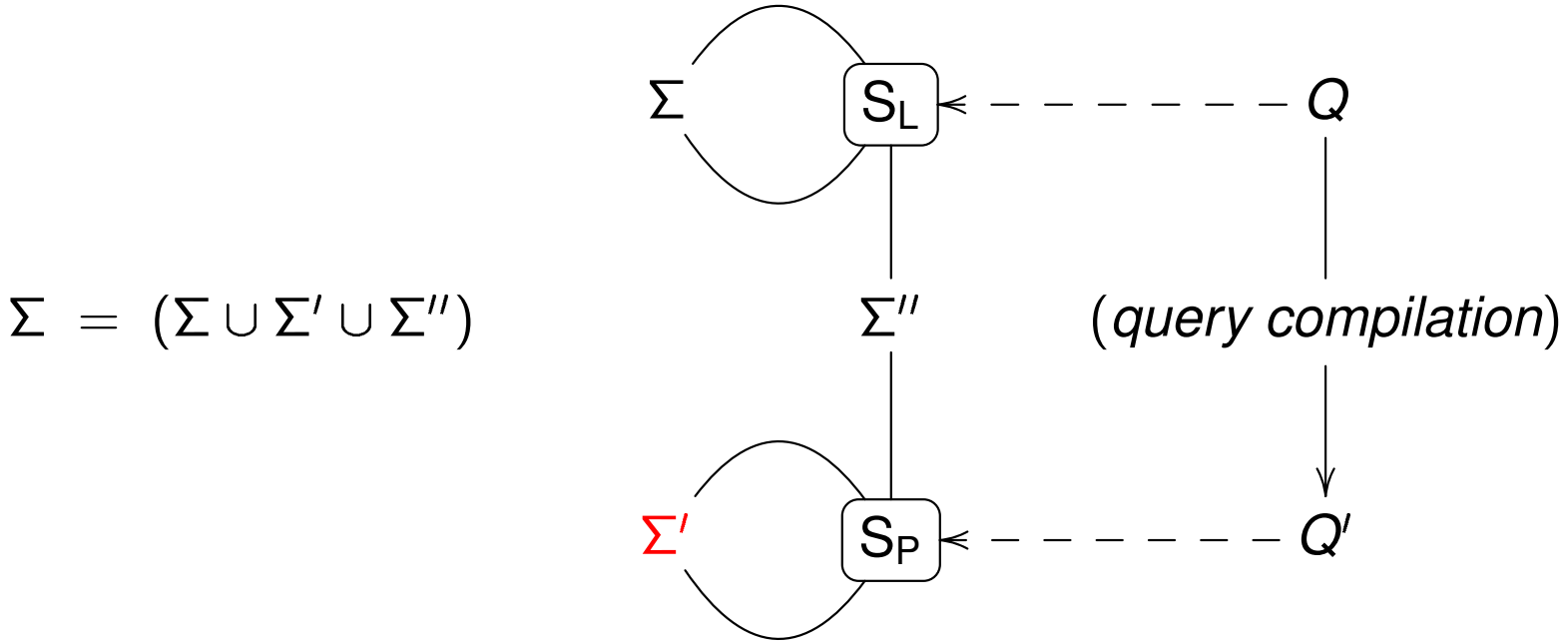

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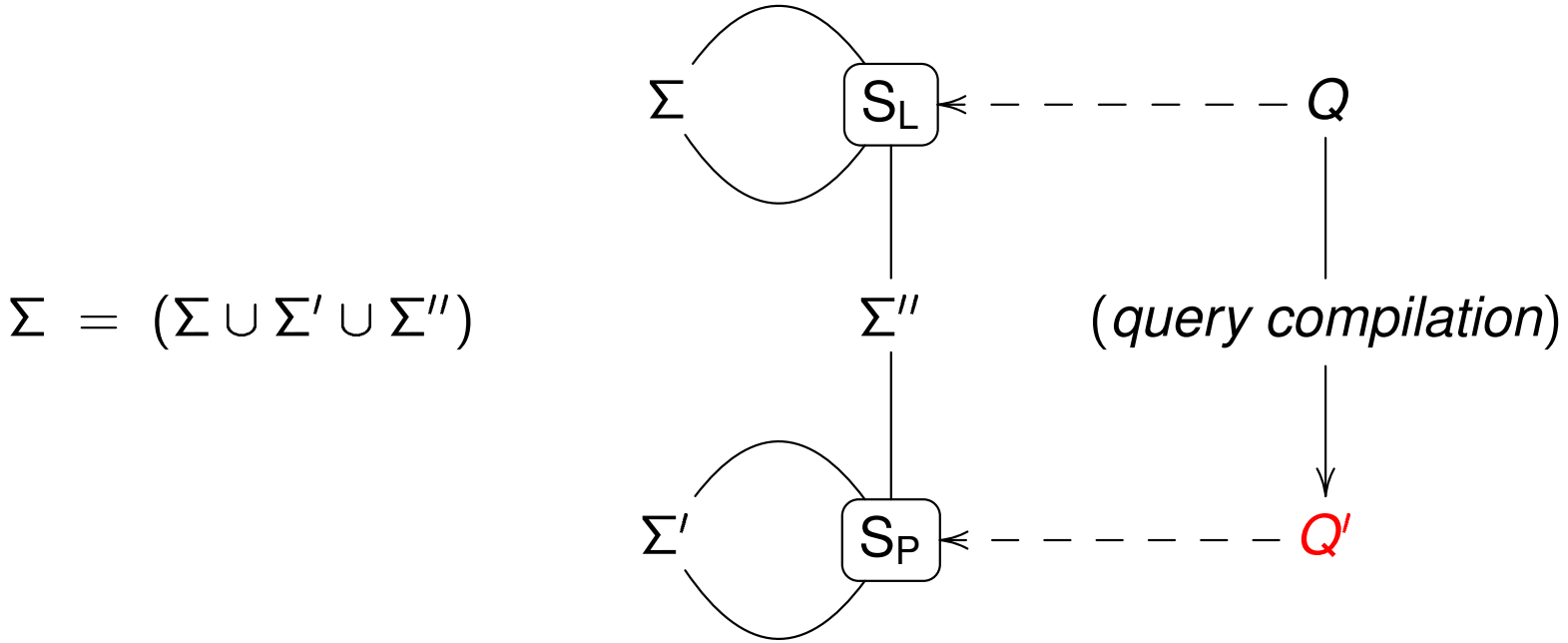

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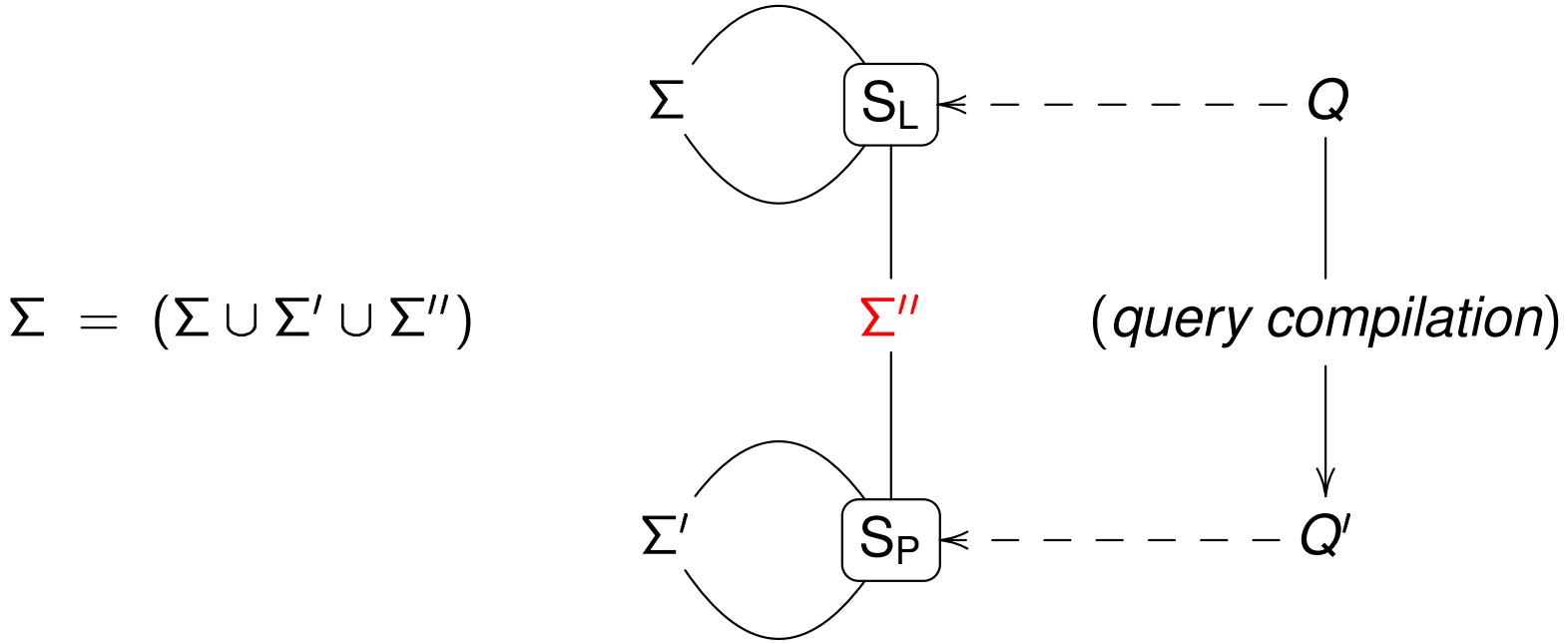

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Food for Thought

Standard (relational) Physical Design

`CREATE TABLE foo` DDL command causes

1. a *logical symbol* `foo` to be created;
2. a (disk-based) *file* of (appropriate) records to be created; and
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Assignment for Discussion in next Lecture:

1. How are the above options *recorded* in a RDBMs? (speculation is ok)
2. Is there a uniform and compact way to describe *all* of the above options?