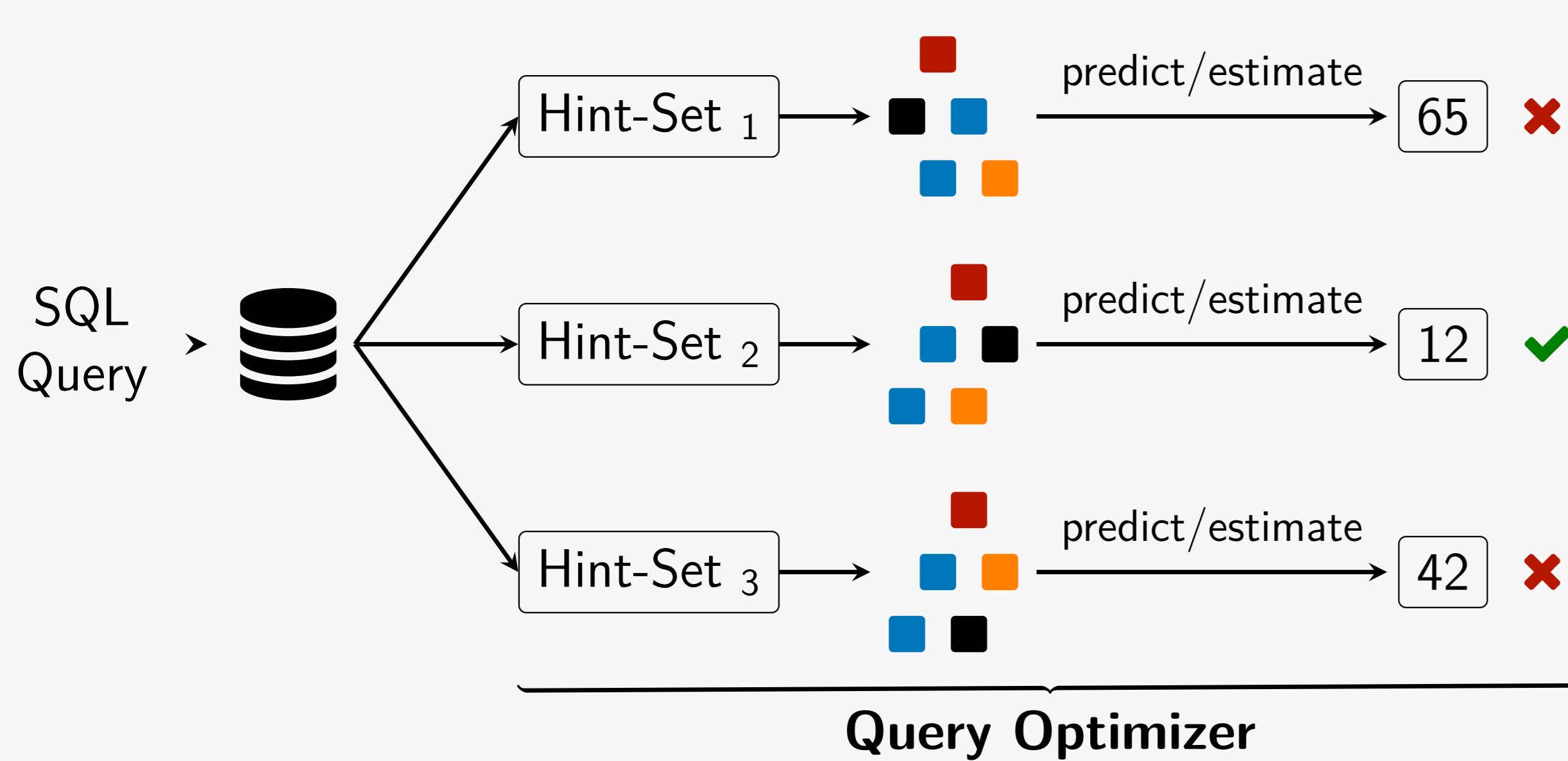


# QO-Insight – Inspecting Steered Query Optimizers

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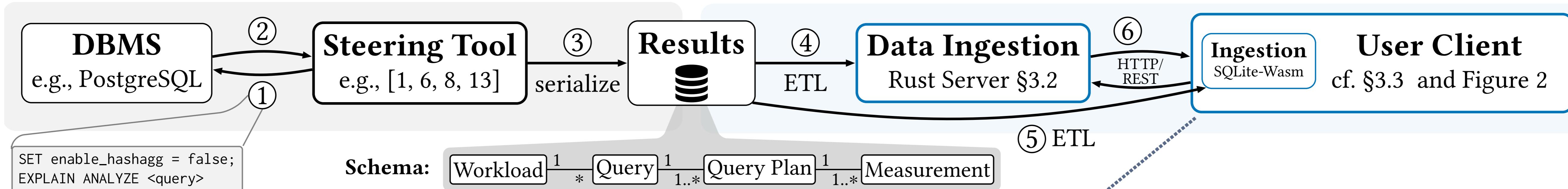
## Background – Steered Query Optimizers



- ▶ Database systems **expose knobs** that can be used to steer query execution. For example, PostgreSQL has knobs to disable nested loop joins or index scans.
- ▶ **Hint-sets** can combine multiple knobs. For example: `{indexscan:false, nestloop:false}`.
- ▶ Recent work on steered query optimizers either adaptively selects [1], predefines [6] or randomly chooses [8, 13] multiple hint-sets, which are used to **generate alternative query plans**.
- ▶ A **deep neural network** predicts the execution time of each plan.

[1] Anneser et al.: "AutoSteer: Learned Query Optimization for Any SQL Database" (VLDB'23)  
 [6] Marcus et al.: "Bao: Making Learned Query Optimization Practical" (SIGMOD'21)  
 [8] Negi et al.: "Steering Query Optimizers: A Practical Take on Big Data Workloads" (SIGMOD'21)  
 [13] Zhang et al.: "Deploying a Steered Query Optimizer in Production at Microsoft" (SIGMOD'22)

## Data Generation §3.1



## QO-Insight

The screenshot shows the QO-Insight interface with several components:

- A Exploration Mode:** A toggle switch between Query Centric and Rule Centric modes.
- B Data Selection:** Options for Database (PostgreSQL), Workload (JOB), and Query.
- C Performance Score:** Sliders for Latency, Rows, Accessed Pages, and Spilled Pages, with an APPLY button.
- D Latency Improvement [%]:** A bar chart showing latency improvement for various queries (11c, 23a, 11b, 11a, 27b, 21a, 13a, 7a, 21c, e10b, 27a, 10a, 26b, e2b, 21b, 17d, 14b, 2c, 19d, 9c, 17a, 2b).
- E Query Performance Table:**

Query	Best Score [%]	Best Hint-Set	Default Latency [ms]	Best Latency [ms]
11c	96.193%	{enable_nestloop}	6360	242
23a	95.219%	{enable_mergejoin}	11281	539
11b	95.036%	{enable_mergejoin}	3418	169
11a	93.774%	{enable_indexscan}	2834	176
27b	90.605%	{enable_gathermerge}	6309	592
- F Query 17d:** A detailed view of a query plan for Query 17d, showing a Hash Join node with two children: Scan title and Hash.
- G Default Plan:** A detailed view of the Default Plan for the same query, showing a Gather node followed by an Aggregate node.
- H Comparison:** A comparison of the Hint-Set plan (Hash Join) and the Default Plan (NL Join).
- I UPLOAD TRACE:** A button for uploading custom trace files.
- HELP:** A help icon.

**A** Users can switch between the query-centric mode for database admins and the rule-centric mode for query optimization experts.

**B** The data selection component allows users to define what data they want to explore.

**C** QO-Insight supports user-defined performance scores to evaluate query plans.

**D** A bar chart visualizes the performance improvements of the selected data according to the performance score.

**E** The table shows more detailed information than the bar chart, is adaptive, and enables the users to export the data.

**F** Users can select two query plans by clicking on the bars, opening the widget in

full-screen mode and showing the two query plans side-by-side. A custom algorithm finds the matching nodes and highlights the difference between the two query plans.

**G** Show actual or estimated cardinalities.

**H** Upload custom trace files and process them entirely within the browser.

### Scenario I: Database Admins

**Goal: Tune the database for a custom workload or query**

- ▶ Switch to **query-centric** mode in **A**
- ▶ Adapt the performance metric in **C**
- ▶ Sort the table in **E** by the performance score
- ▶ Select the best hint-set for the query and apply it

### Scenario II: Query Optimization Experts

**Goal: Improve the query optimizer's implementation**

- ▶ Switch to **rule-centric** mode in **A**
- ▶ Click on two bars in the bar chart and open **F**
- ▶ Compare the two query plans
- ▶ Improve the query optimizer implementation