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Ask Your Data Anything!
LLMs for Effortless Database Insights

Swiss AI Weeks 2025

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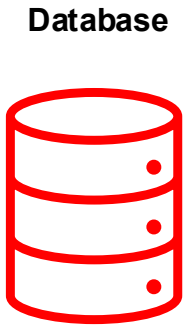
Data Access in RDBs
Current Status Quo

- Most users do not know how to write SQL queries
- Relational DBs can have **extremely complex schema** (tables & columns)
- Most data extractions are done via **hard-coded queries** (i.e. using a DB as a module of another application)
- In **exploratory tasks** (i.e background checks) users need to request data from DBAs who must spend time manually writing complex queries ==> **extracting information from DBs is slow and expensive**



Goal: Allow users without any SQL knowledge to extract data from RDBs for exploratory tasks

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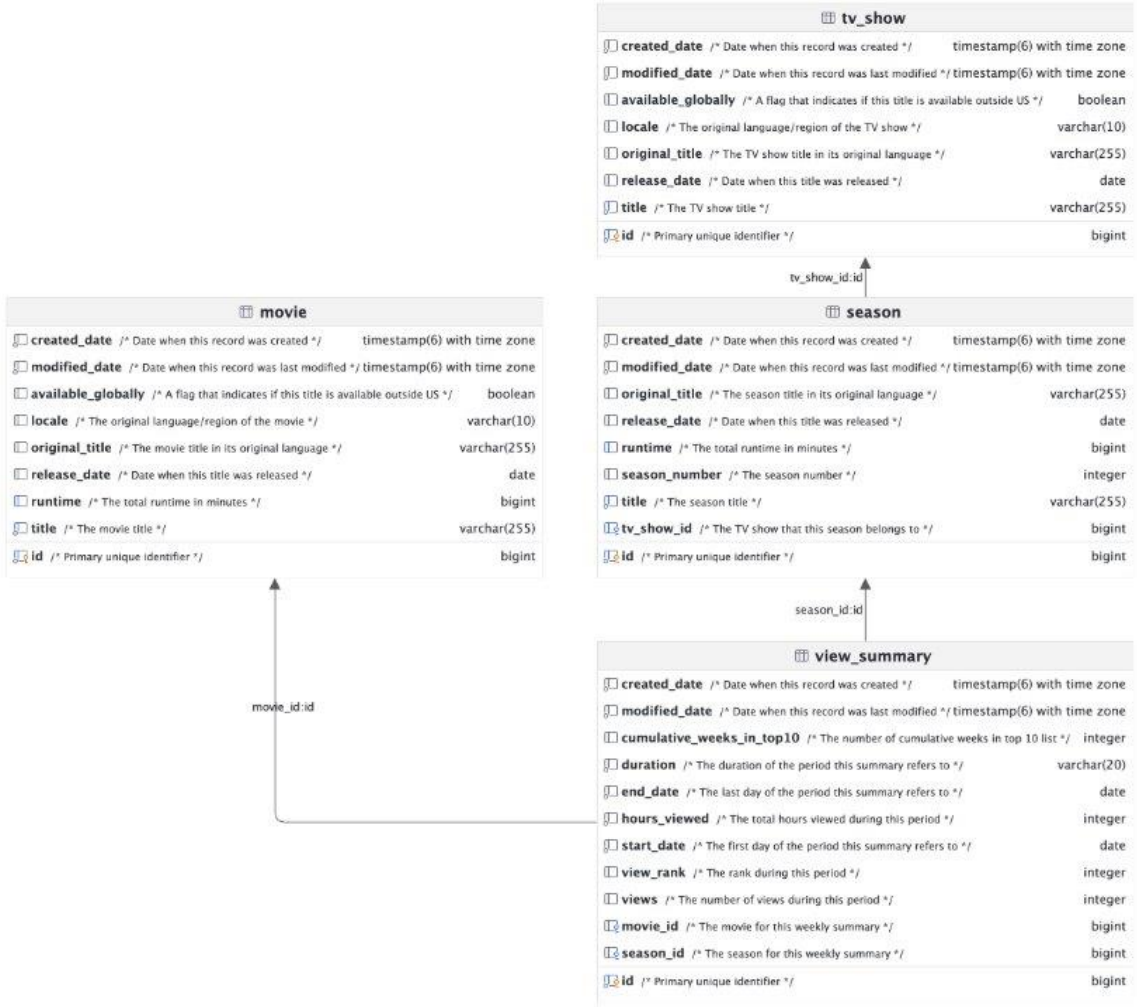
Data Access Running Example

- Open-source DB (available on Github) based on the data from the **Netflix Engagement Report** and the **Netflix Global Top 10 weekly list.**

- Simple schema yet exploratory tasks can lead to **complex queries**.



- The query below retrieves the **seasons of a given tv show** ranked by the number of views.

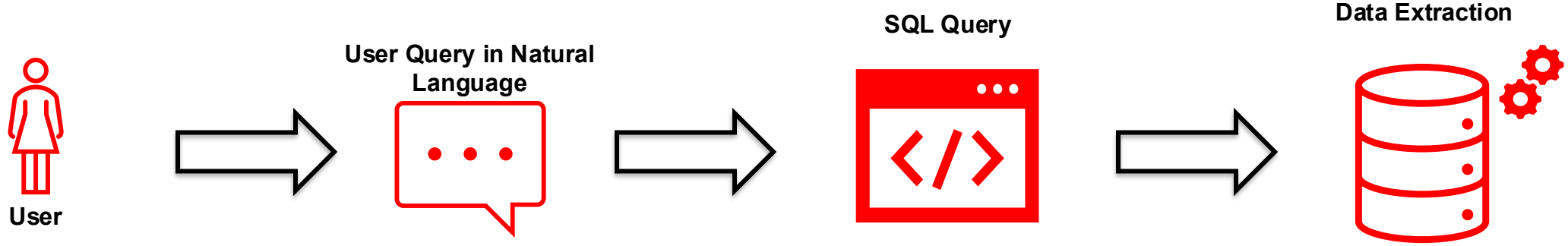
- It is a **relatively simple query**, but the multiple JOINs, the GROUP BY, ORDER BY and RANK() can be intimidating for users without SQL knowledge.

Example TV Show:

Floor is Lava


```sql
SELECT
    s.title AS season_title,
    s.season_number,
    SUM(vs.views) AS total_views,
    RANK() OVER (ORDER BY SUM(vs.views) DESC) AS view_rank
FROM
    tv_show tv
JOIN
    season s ON tv.id = s.tv_show_id
JOIN
    view_summary vs ON s.id = vs.season_id
WHERE
    tv.title = 'Floor is Lava'
GROUP BY
    s.id, s.title, s.season_number
ORDER BY
    total_views DESC;
```

NL2SQL overview



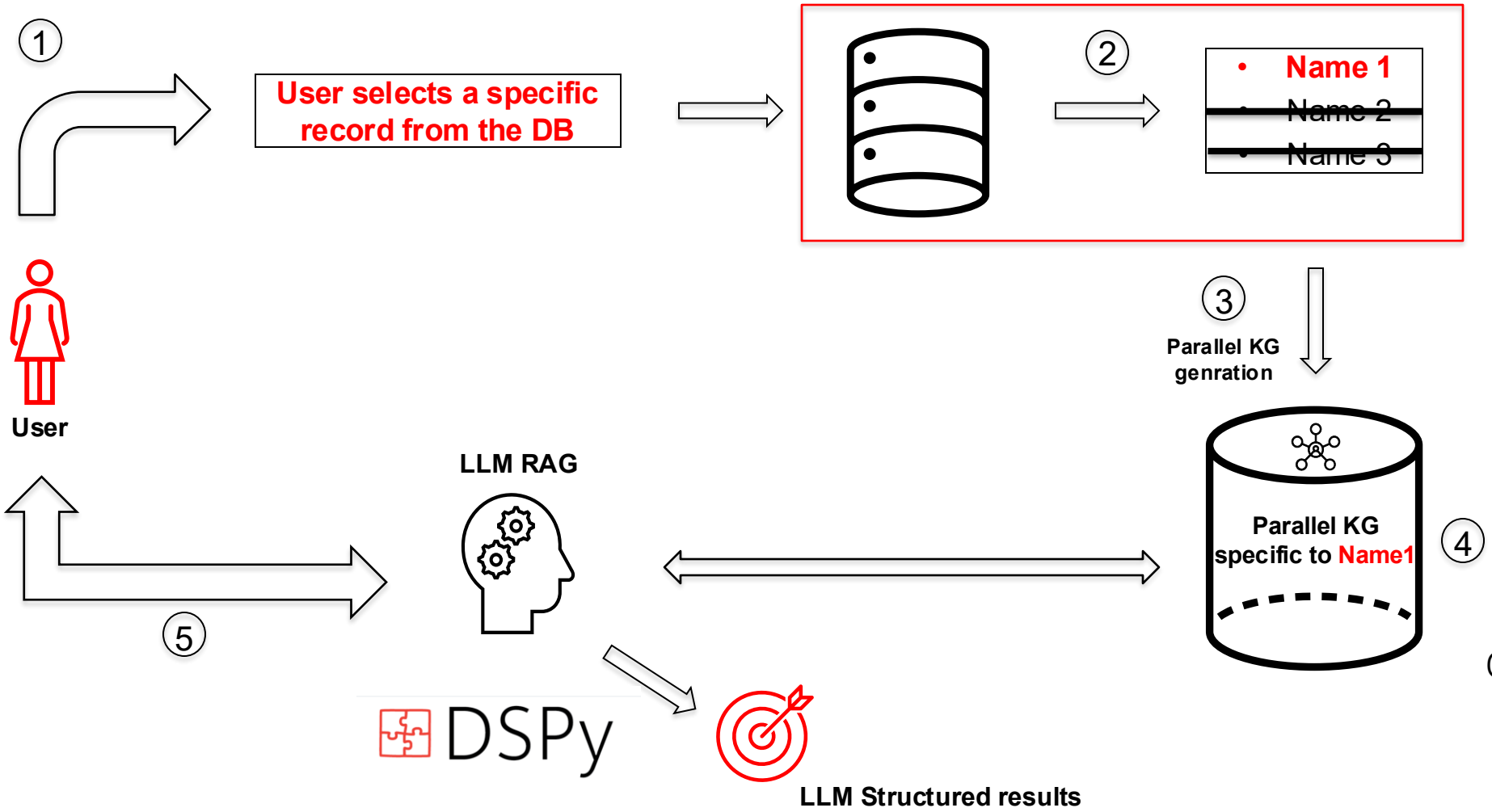
- **VERY COMPLEX** research problem in general (**difficult to evaluate** performance + easy to fail in multiple ways)
- NL queries and SQL queries have conflicting natures (**ambiguous** vs **strictly formatted**)
- Most deployed systems can only aid users (greatly reducing query writing time), but **some SQL knowledge from users is still required**

However, in our case, we are only interested in a reduced number of rows at a time…

Example TV Show:
Floor is Lava

- All of the information related to a specific tv show can be accessed by exploring the **Primary/Foreign Key relationships** in the DB, which imply a Knowledge Graph.
- Users could manually explore the KG searching for the information they need, but this is **infeasible when dealing with complex schemas**.

Methodology



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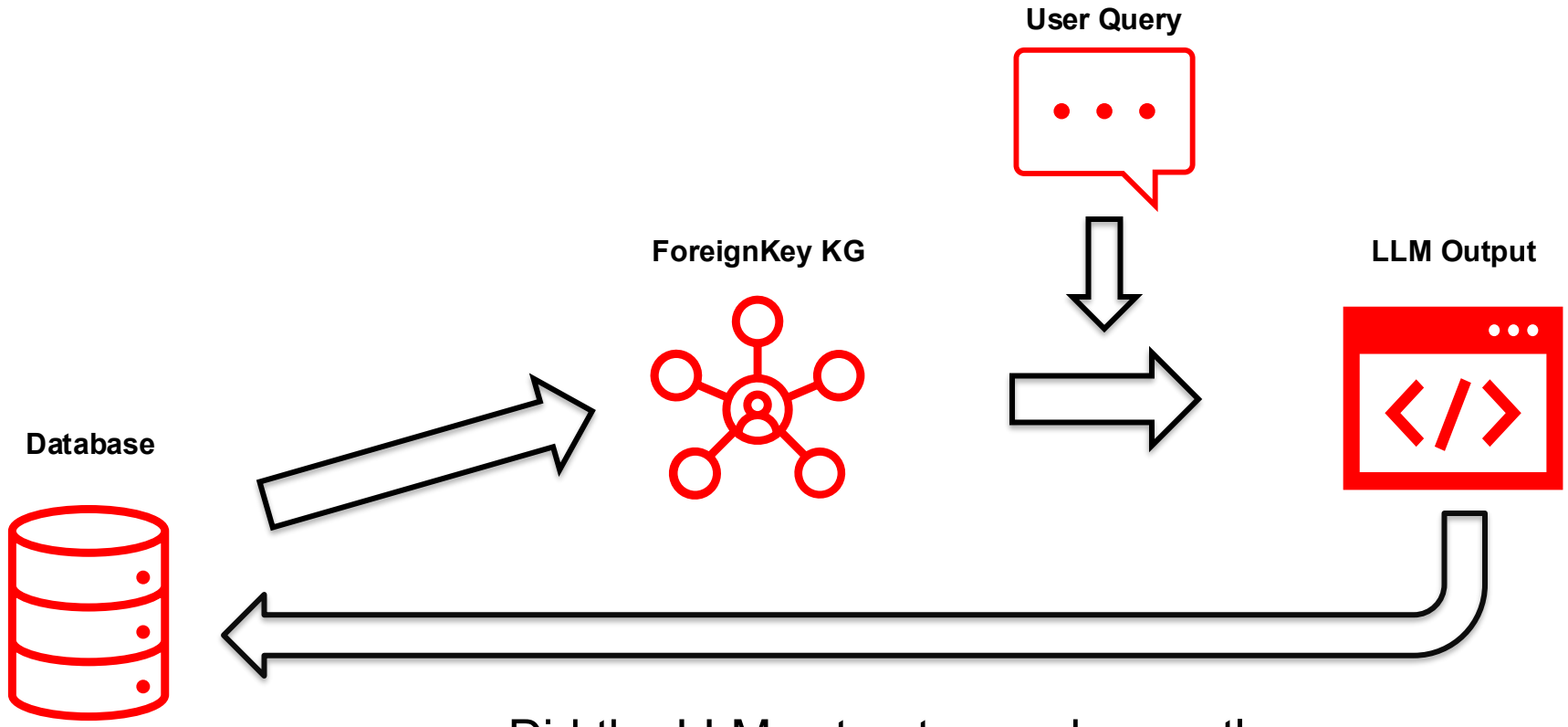
Authenticity Guardrail



Did the LLM extract records exactly matching those in the DB?
We can **always** validate record extraction.

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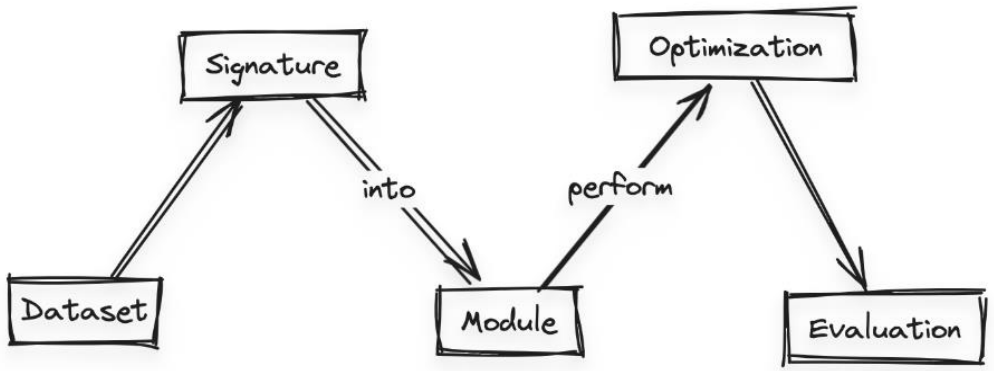
Methodology

DSPy *Programming—not prompting—LMs*

DSPy is the framework for *programming—rather than prompting—language models*. It allows you to iterate fast on **building modular AI systems** and offers algorithms for **optimizing their prompts and weights**, whether you're building simple classifiers, sophisticated RAG pipelines, or Agent loops.




```python
class MyProgram(dspy.Module):

    def __init__(self, ...):
        # Define attributes and sub-modules here
        {constructor_code}

    def forward(self, input_name1, input_name2, ...):
        # Implement your program's logic here
        {custom_logic_code}
```

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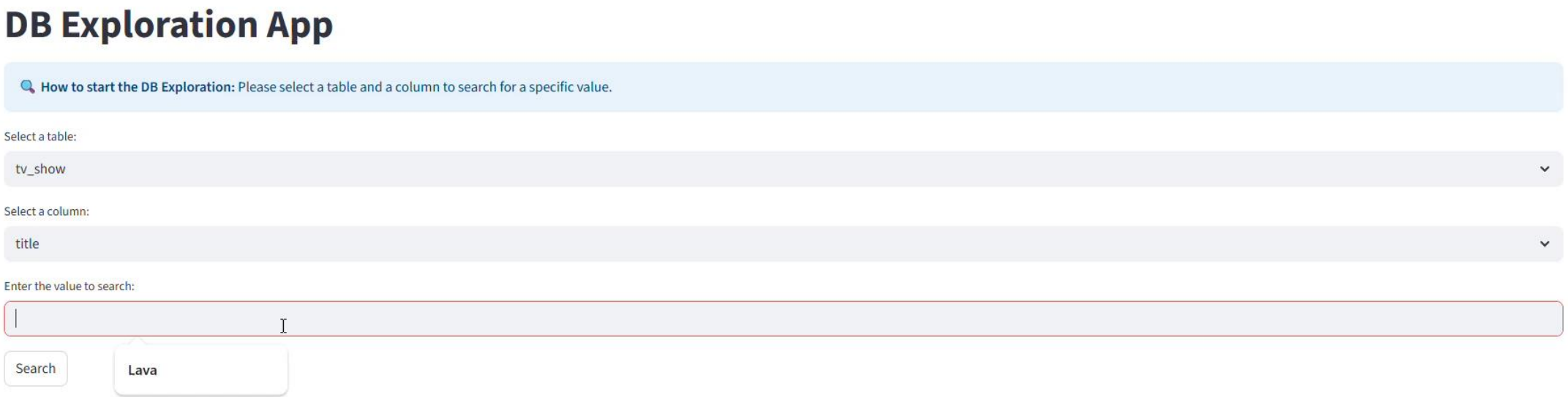
PoC video walkthrough

Deploy



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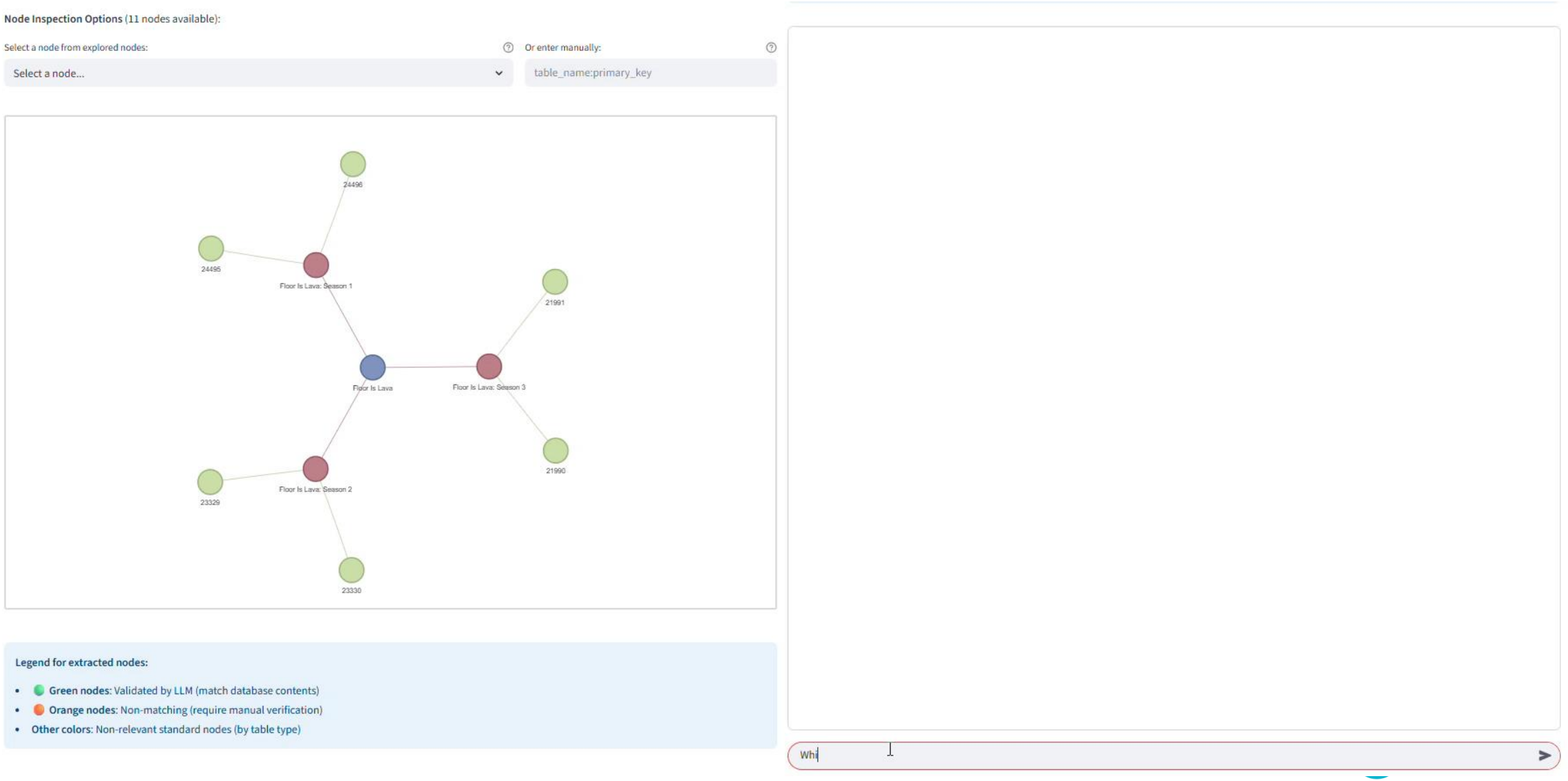
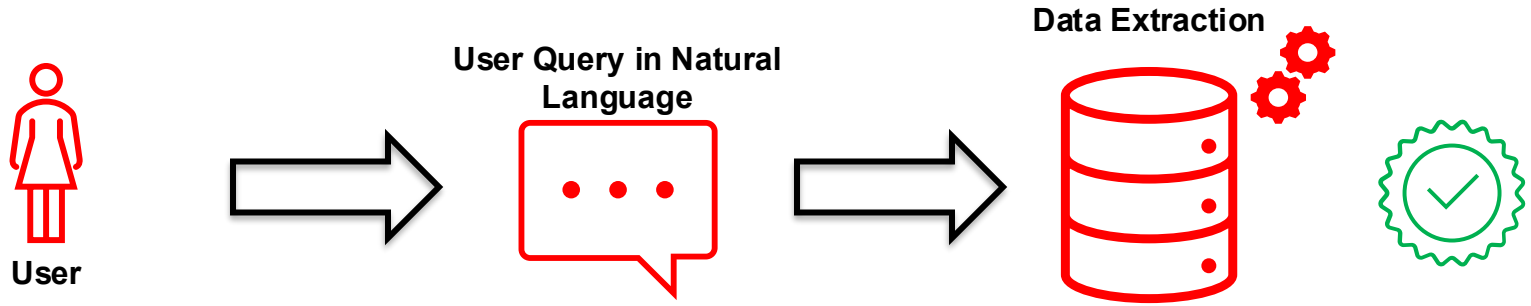
Auth Guardrail video walkthrough



Conclusions

- NL2SQL is a very complex problem in general, but extracting information from small sections of a DB is a **much easier task**.
- Current LLMs are **very proficient** at simple, self-contained tasks.
- The rich structure of RDBs **allows for the verification** of extracted data.



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Demo / QA

Thank you for your attention!

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