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A Large Language Model-Based Framework for Enhancing Integrated Regression

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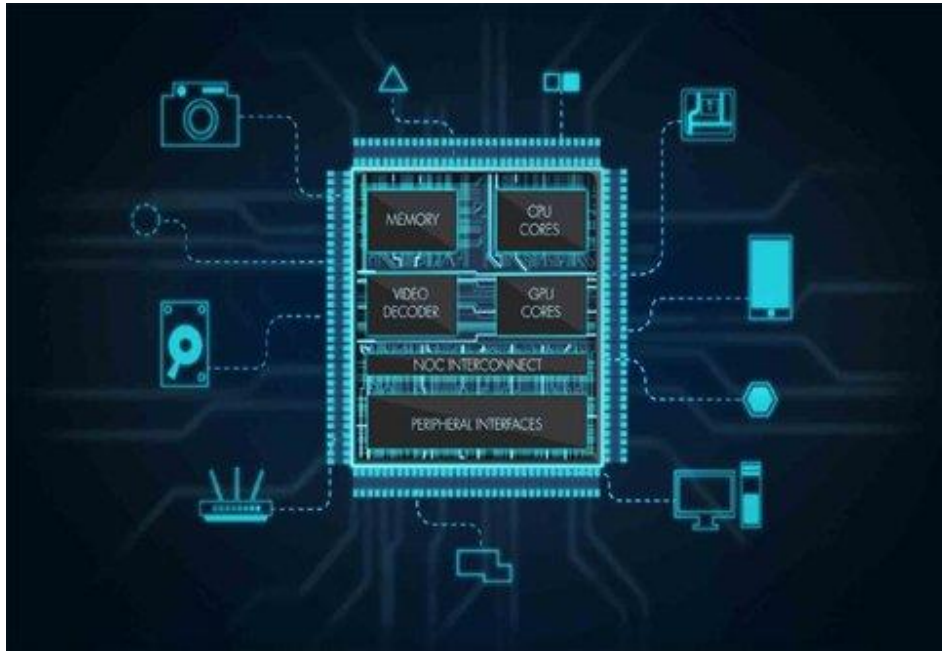
SAMSUNG

accellera SYSTEMS INITIATIVE

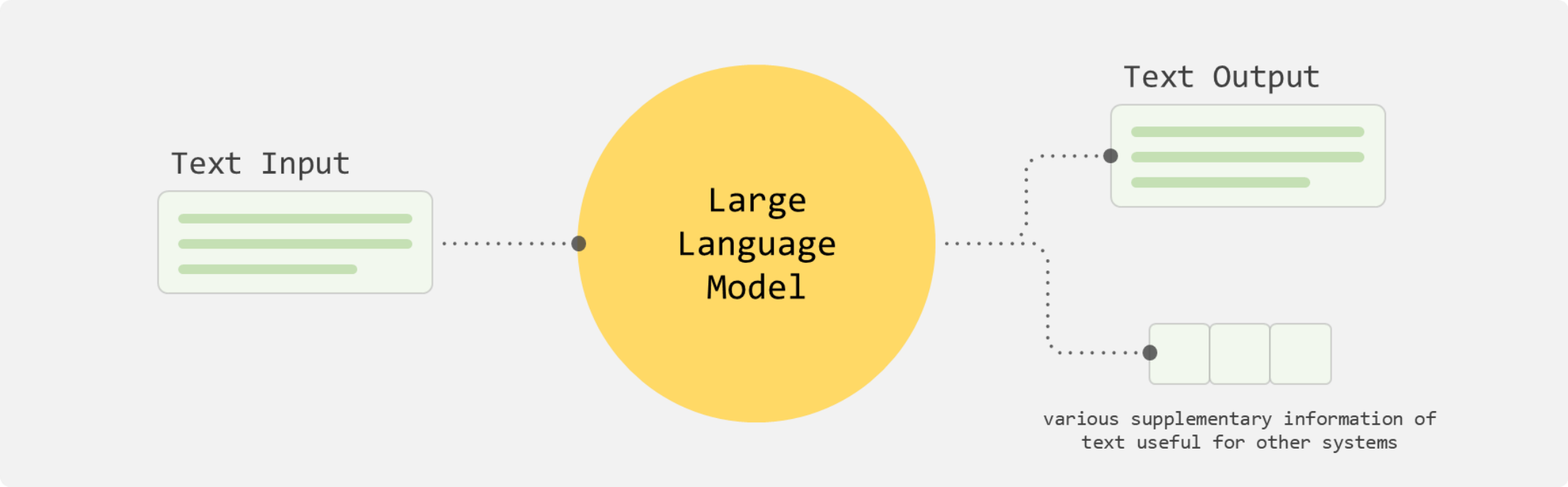
Importance of Integrated Regression



Major Challenges

- Test Case Prioritization
- Log Volume Overload
- Data Availability

How Can We Solve These Problems?



1. Test case Prioritization Optimization

Can’t We Handle it Ourselves?

30,000+ test cases *for each regression!*

Impossible to manually assess priority in real-time.

Dynamic Test case Prioritization

- Early Verification Stage
  - Frequent RTL changes → ***Critical design bugs***
  - **Goal**: Quickly identify and fix design bugs

- Later Verification Stage
  - Mature RTL → Focus shifts to ***consistent failures***
  - **Goal**: Prioritize unresolved failures

Context-Aware Prioritization

Can LLM ***Interpret the verification context***

and optimize prioritization of test cases?

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However, LLM cannot handle **all test cases at once** because of **input token constraints**.

Factors Affecting Test case Prioritization

- How many ***design changes*** have occurred?
- How long has it remained in a ***failure state***?
- How long does is the ***running time***?

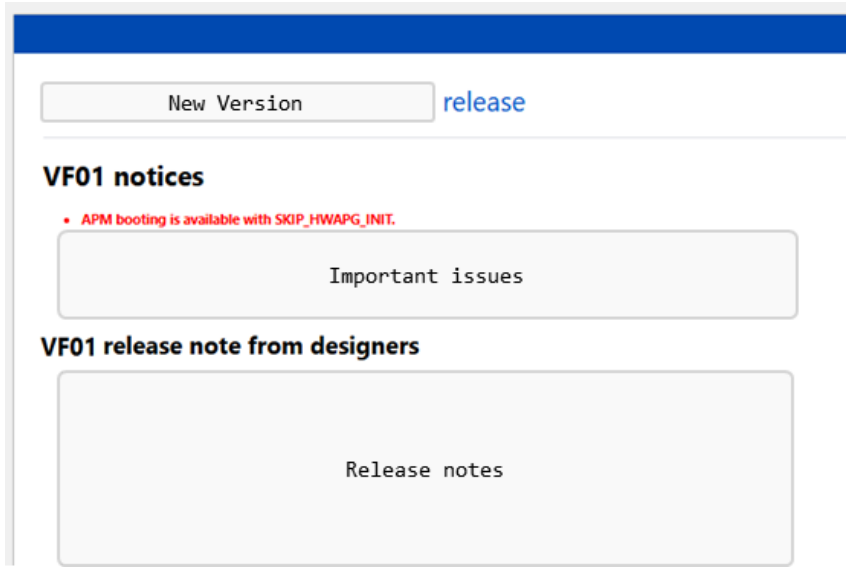
`Change Impact`

`Execution Cost`

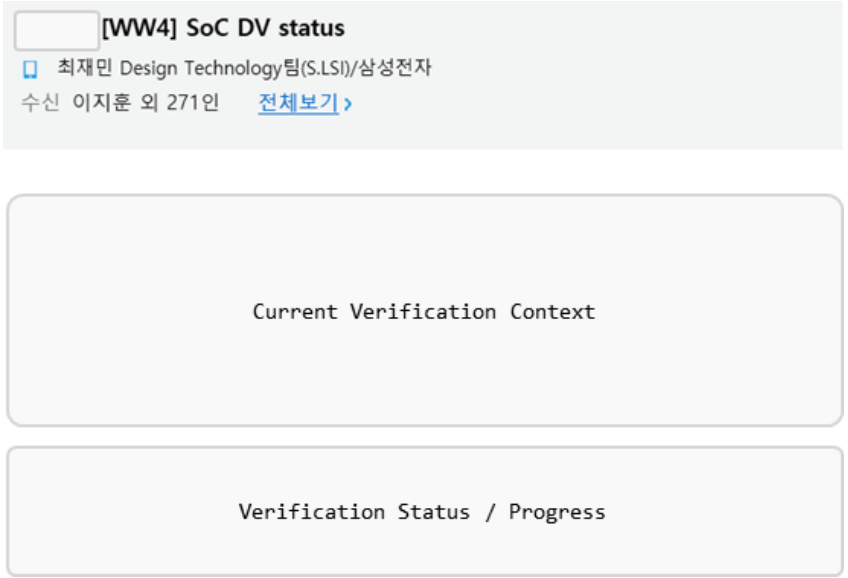
`Regression History`

Verification Context Materials

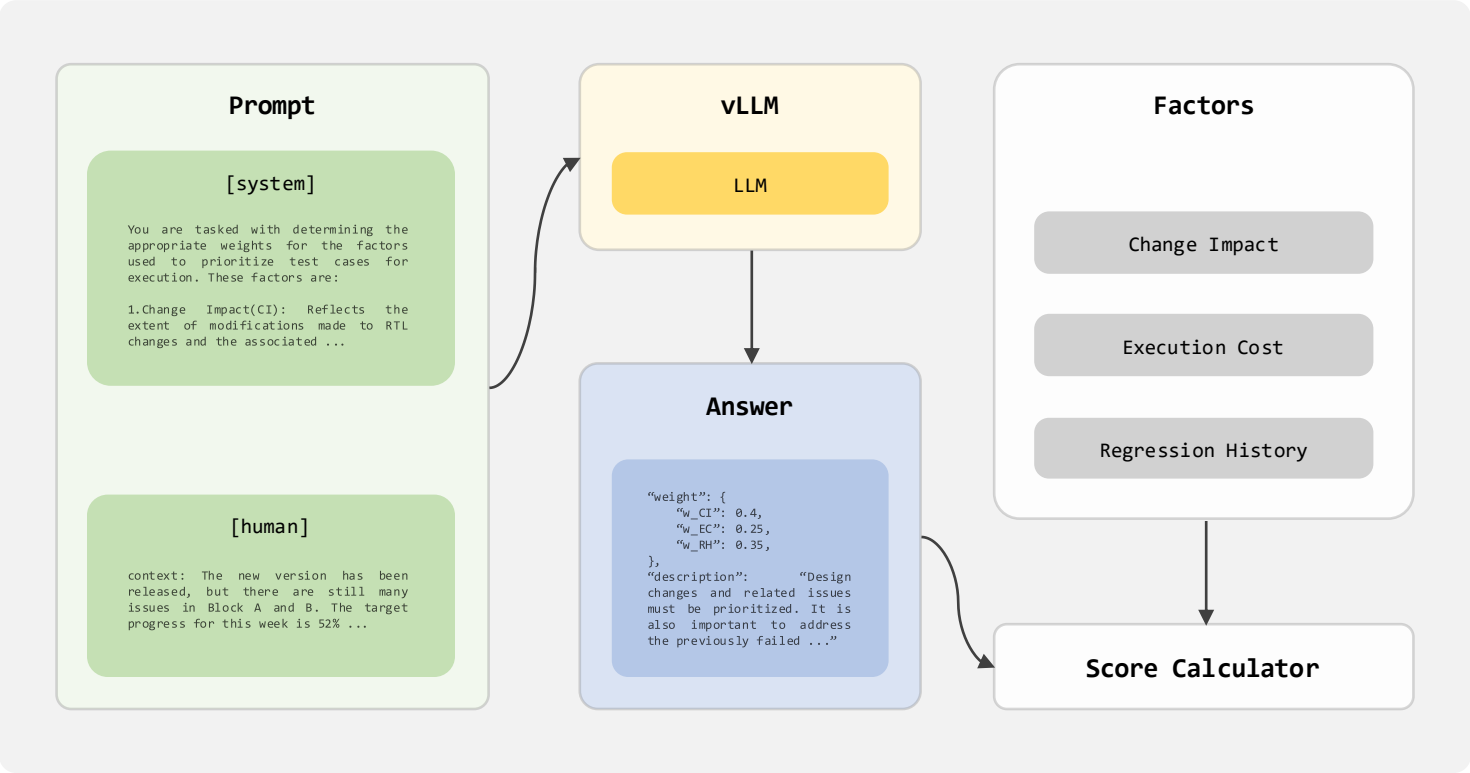
- Release Notes



- Weekly Reports



Overall Structure



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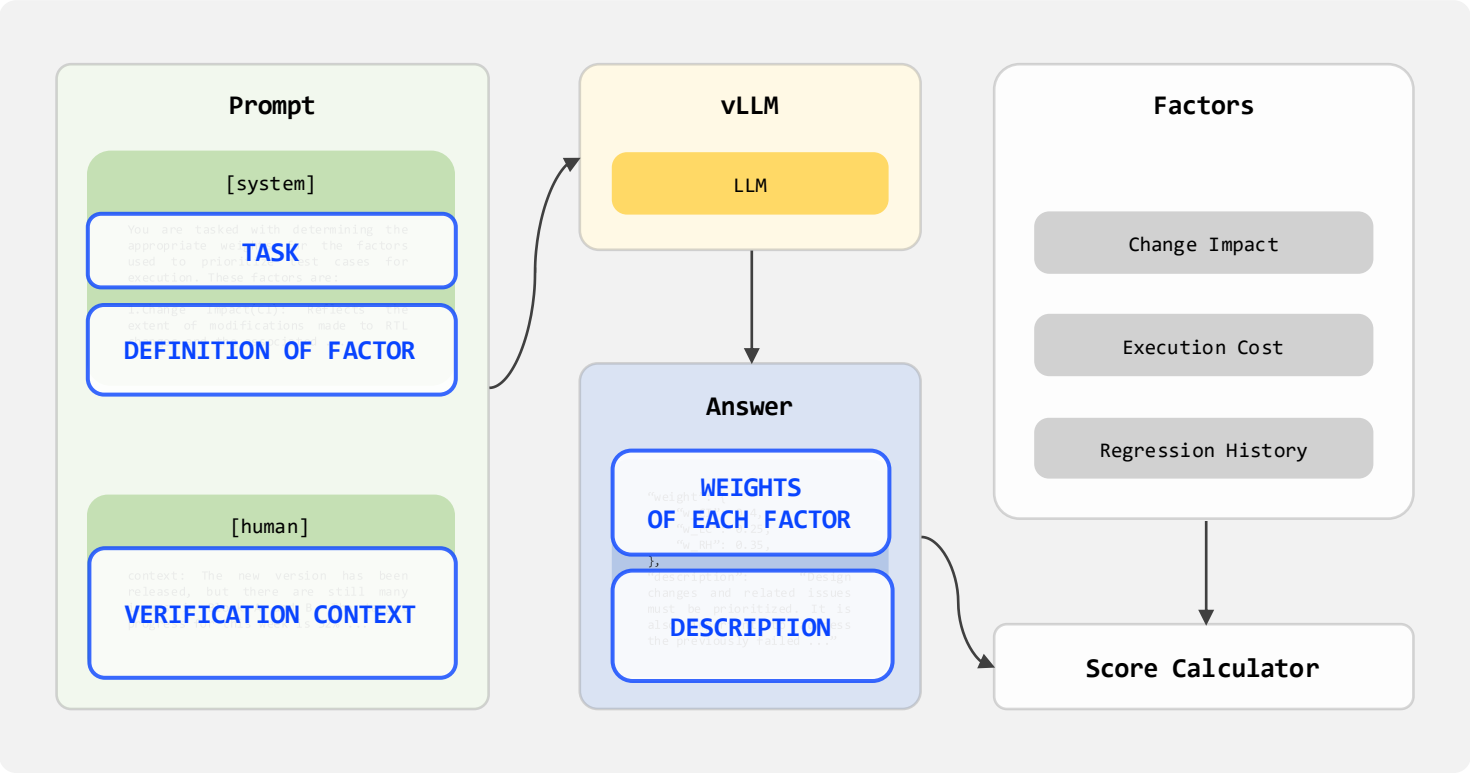

Dynamic Test case Prioritization - ***Pros***

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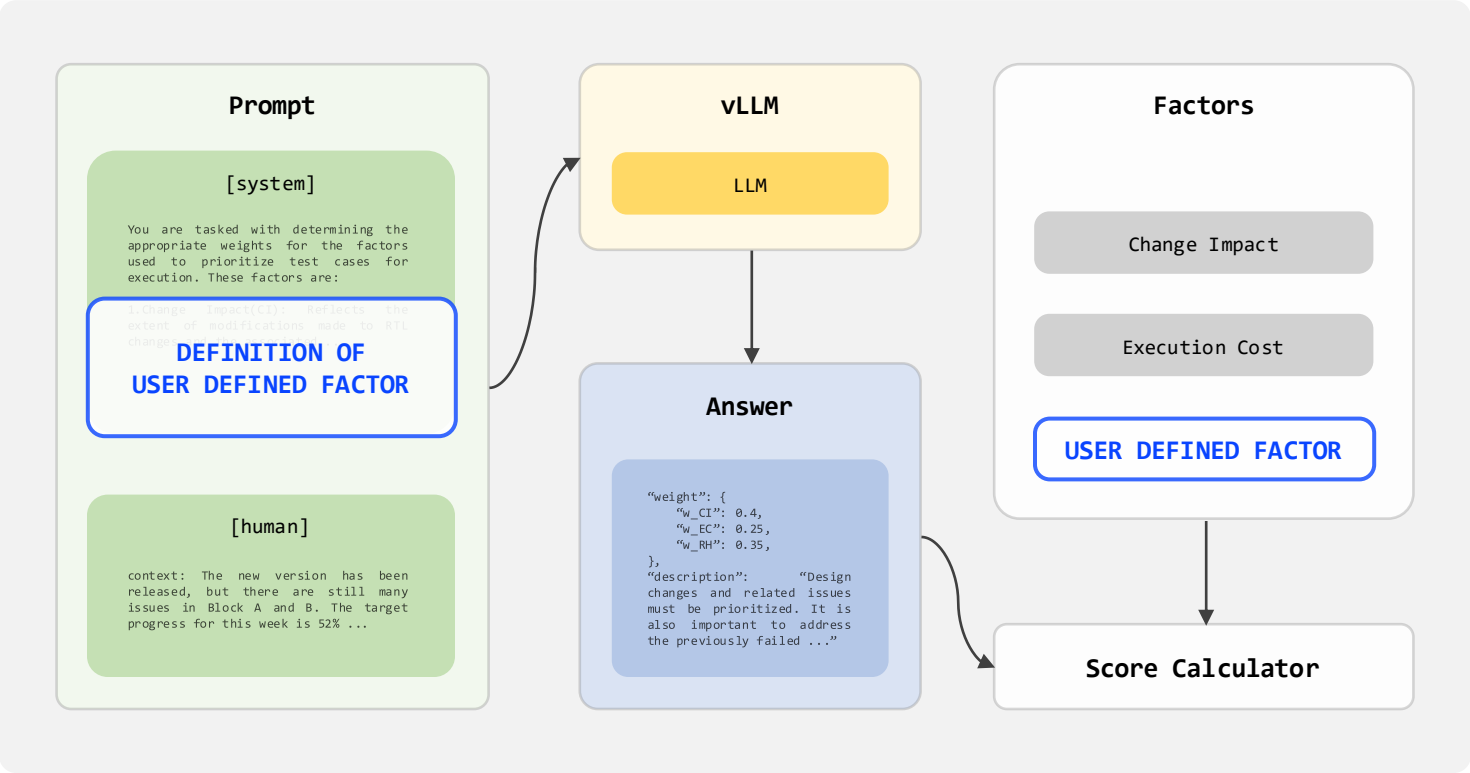
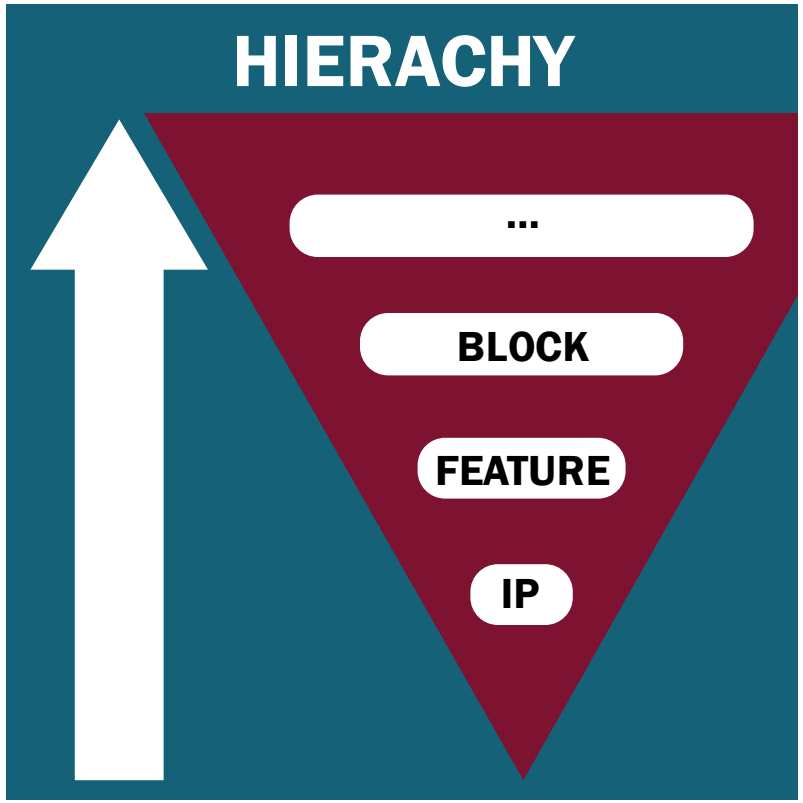


Dynamic Test case Prioritization - ***Cons***



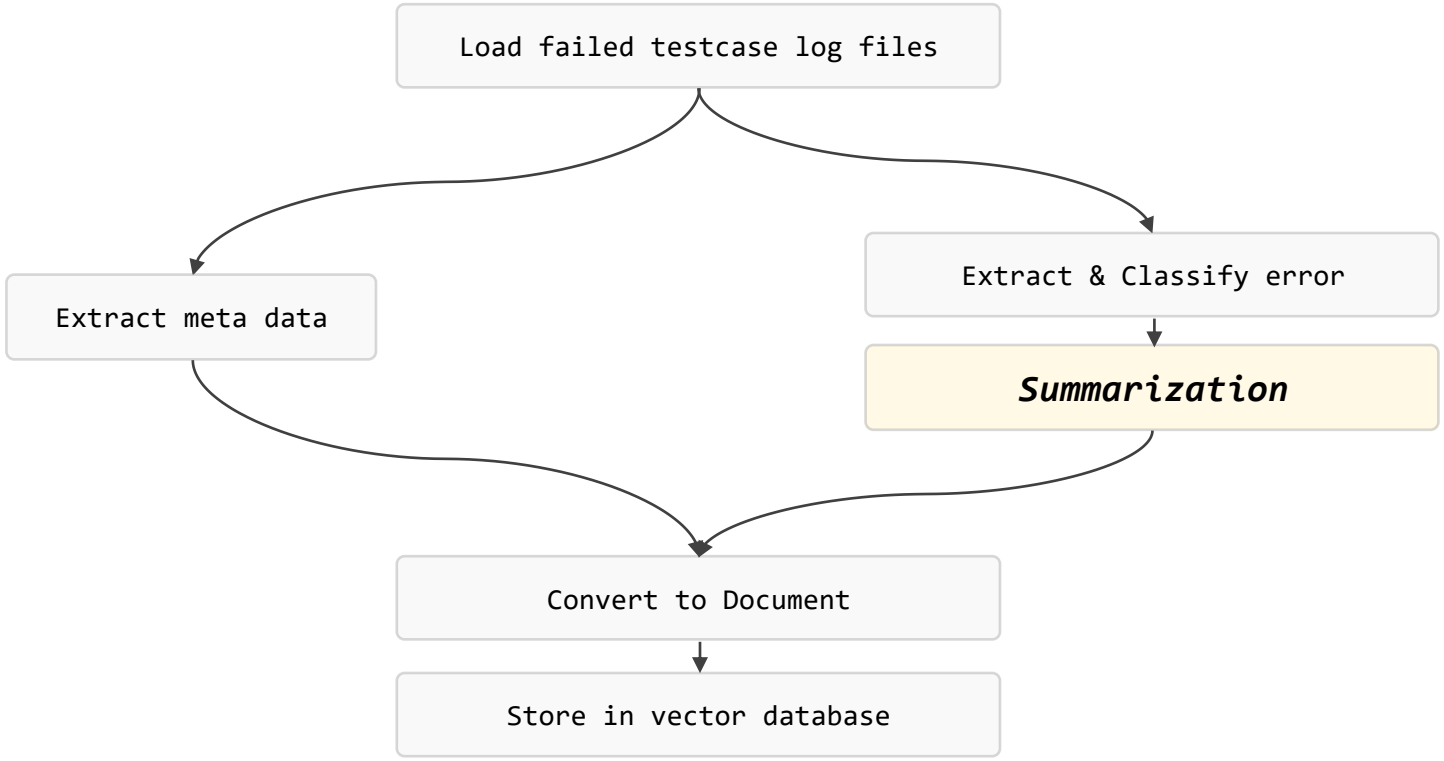
2. Log Management

Too Many Log files …

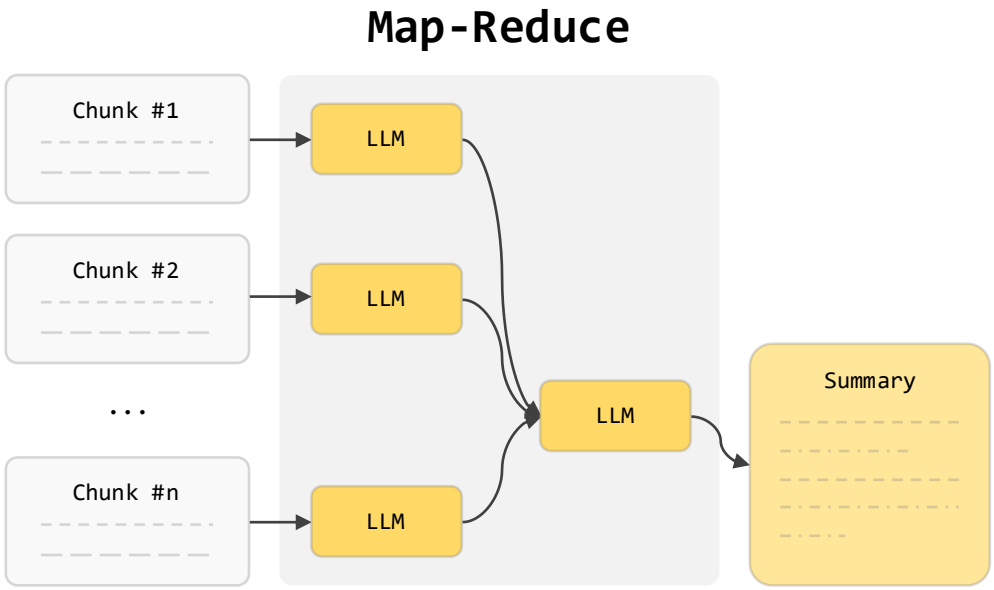
Pain Points

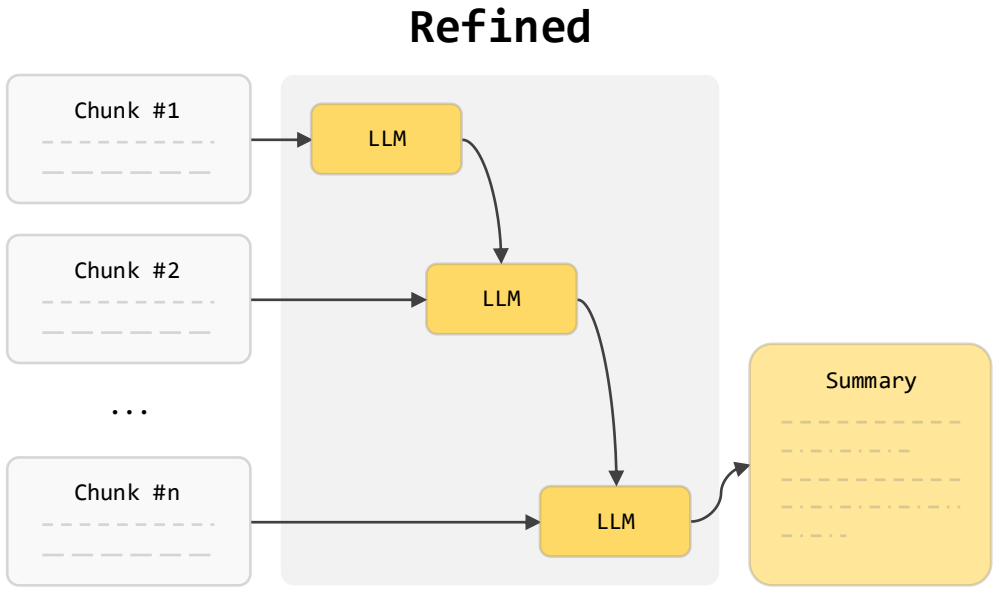
- Simulation logs are ***massive*** and ***unstructured***.
- Engineers ***manually*** analyze, classify, and group errors.
- Duplicated errors → ***Redundant efforts***.

How to Manage Log files?



Map-Reduce vs. Refined Approaches

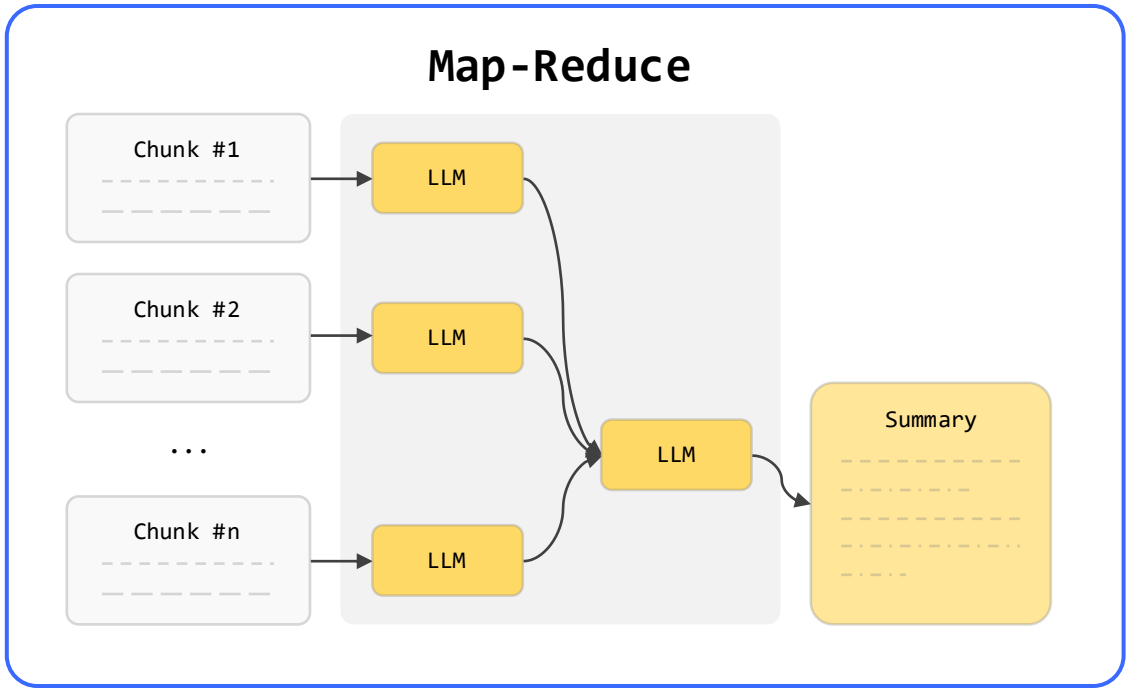




- Scalable with distributed processing
- May lose contextual consistency

- Ensures coherence and accuracy
- Limited scalability

Why We Chose Map-Reduce Approach



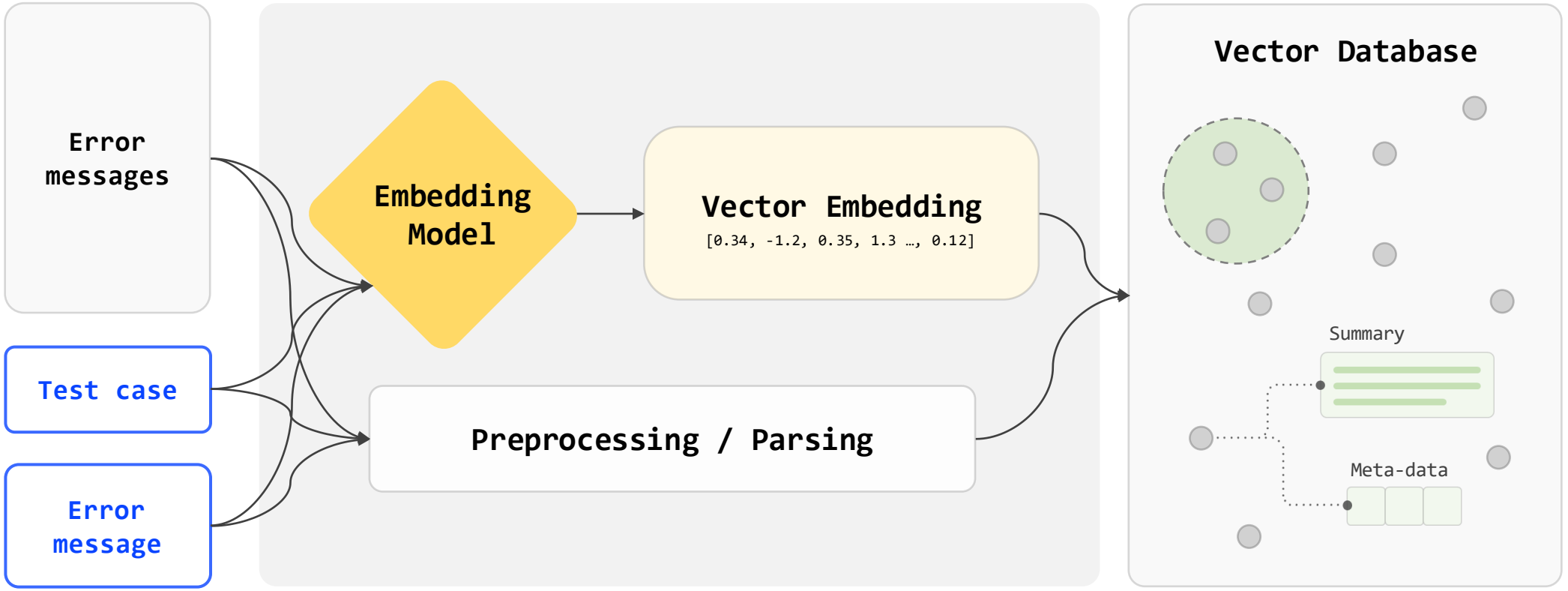
- Faster processing
- Scalable solution
- Maintains accuracy

Key Summarization Process Decisions

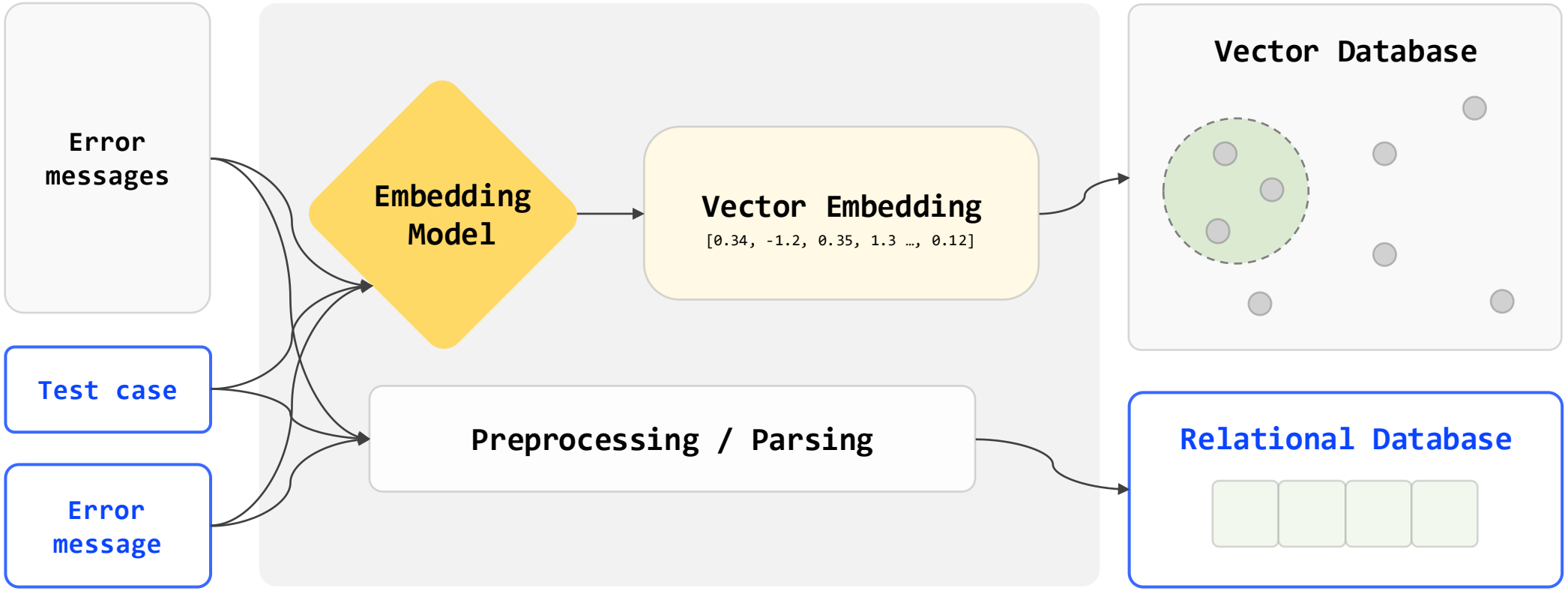
- ***No prior preprocessing***
  - Avoided distortion from removing numbers/special characters
  - Preserved file paths & error contexts

- ***Collapse loop capped*** at 15 iterations
  - Prevent excessive computation time
  - Balanced completeness and efficiency

Key Contributions of Our Approach



Future Work – Vector Database with RDB



3. Data Availability with Agent

Challenge

Struggle with Data and Repetitive Tasks

- Scattered data accumulation
- Repetitive & manual tasks
- Access & retrieval challenges

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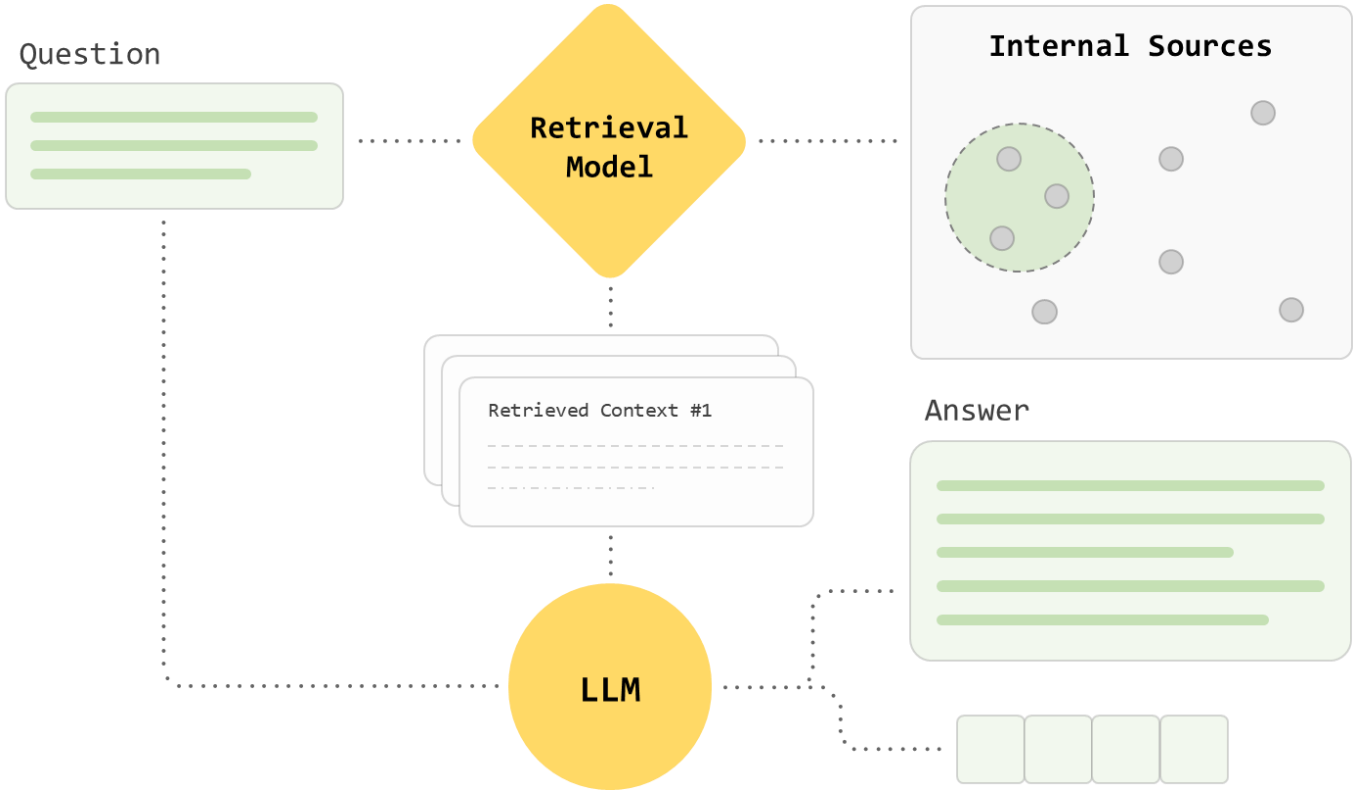
Impact on Verification Efficiency

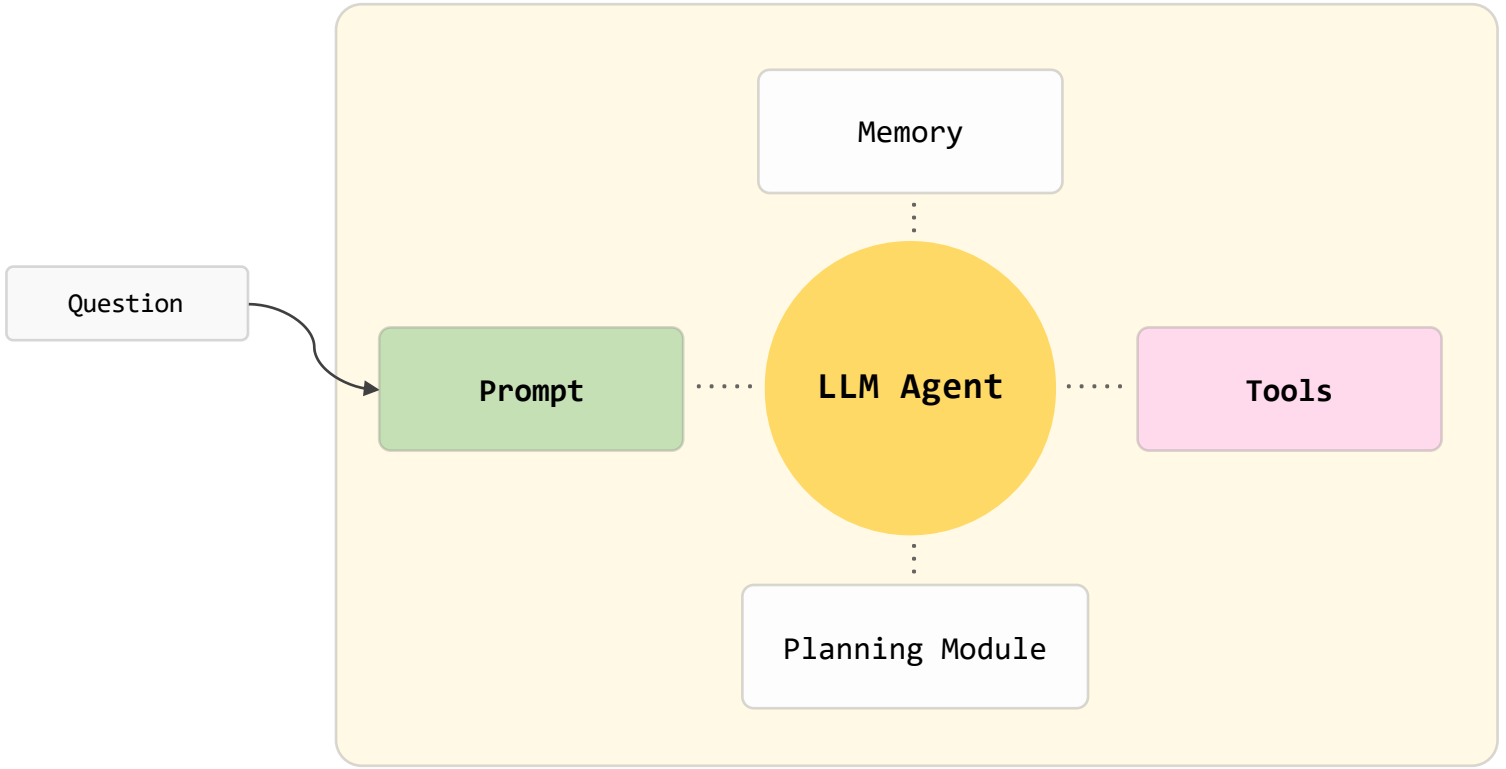
Limitations of LLMs

- ***Hallucination*** and inaccurate outputs
- ***Outdated*** and limited information
- ***Untraceable*** reasoning & bias

Retrieval Augmented Generation (RAG)



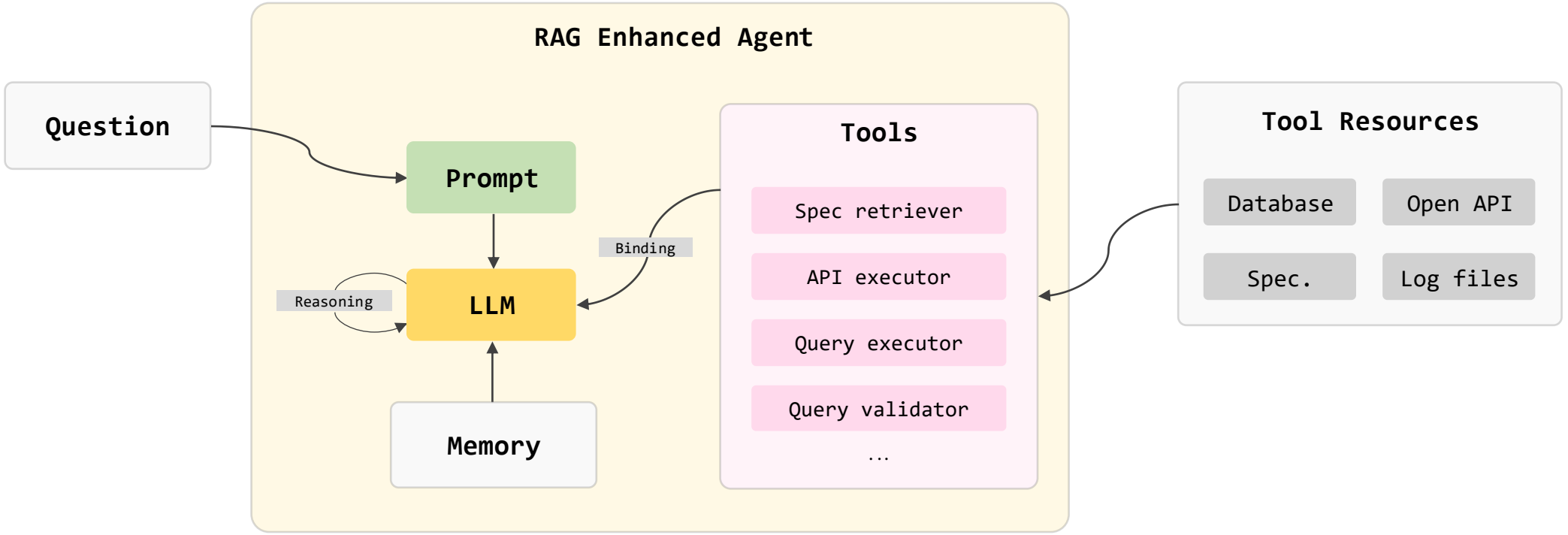
The Role of an Agent



What Agent Does

- ***Automated tasks*** that are repetitive and time-consuming
- Improvement in ***accuracy of data processing***
- ***Extensibility*** to handle a ***integrated*** workflow

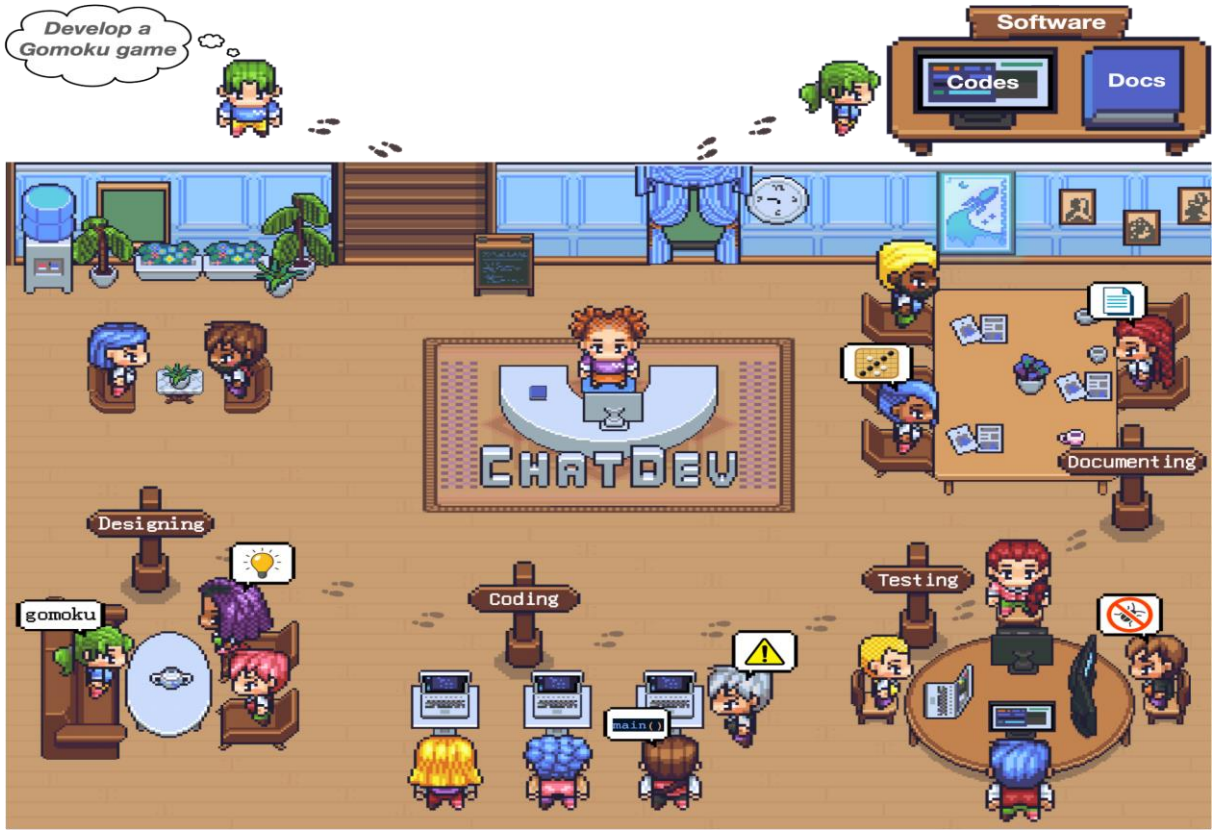
Application Paradigms



Data Availability with Agent - ***Extensibility***

Data Availability with Agent - ***Shortcuts***

Future Work – Multiple Agent

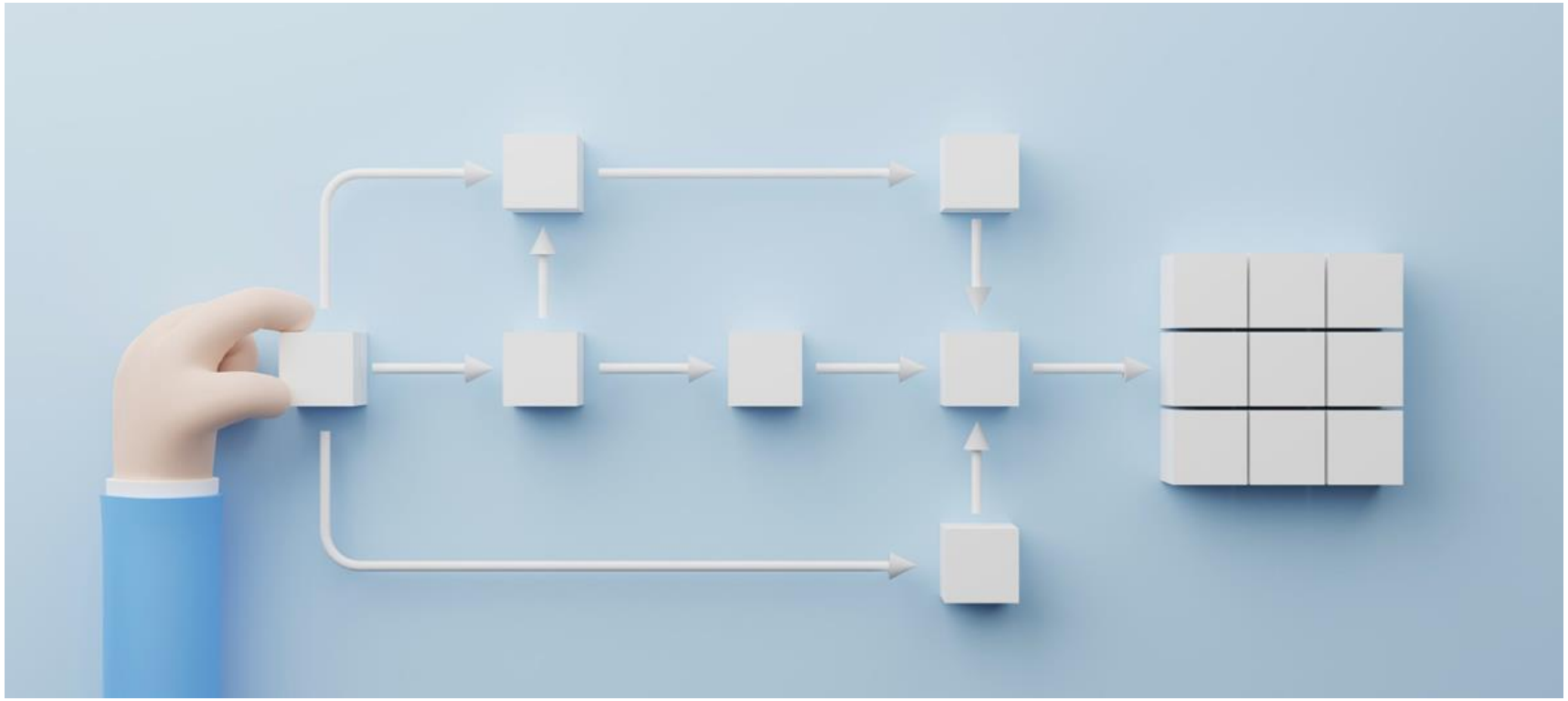


Summary

For Enhancing ***Integrated Regression***

A ***Large Language Model*** *- Based Framework*

Conclusion



Thank You!

- Questions?

- Contact

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