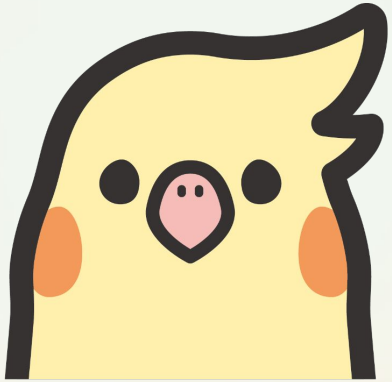


Teammately

the **AI AI-Engineer**

Tom Ohtsuka, founder of Teammately

LLM-based AI Development

is VERY challenging

Teammately

Challenges in LLM-based AI Dev

Model Upgrades

I started using new models
reported better in HF Leaderboard

but the quality looks degraded
in MY case

[Developer's Dilemma]
New models are not necessarily like a library version upgrades.
Later models might work poorly than their previous.
At least, they work “differently”.

gpt-4 ▶	gpt-4-turbo ▶	gpt-4o
Llama 2 ▶	Llama 3 ▶	Llama 3.1

Challenges in LLM-based AI Dev

Prompt Tunings

I added rule instructions then reported bugs fixed

but new bugs are created by overly referring them in other cases

[Developer's Dilemma]
In general, longer and complicated instructions in prompt text make the results less focused. It's even more complicated if the instructions have "IF-ELSE" like directions. Developers can't simply add few lines of directions to fix a particular bug, unlike they may do in coding.

Challenges in LLM-based AI Dev

New Data to RAG

I incremented new data to cover bigger knowledge

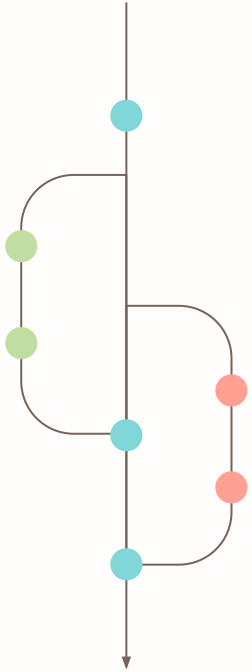
but the context recall or kNN precision worsen by having noises

[Developer's Dilemma]
Unlike static databases like SQL, text corpus returns results in different orders by how to handle the original data.
Options to tune the search is literally infinite.

[Developer's Dilemma]

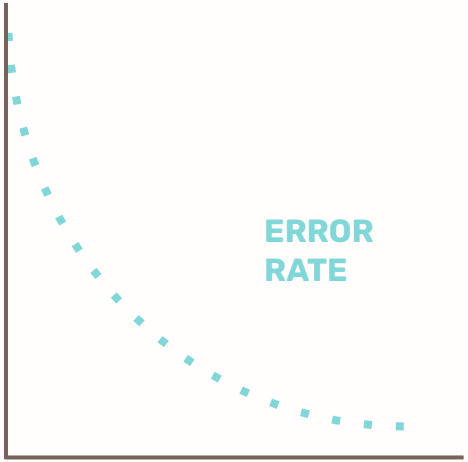
- Updating one part to fix particular issue causes degradation in some other areas.
- No universal best practice that fits all.
- VERY challenging to find the optimal architecture among infinite number of options.

Web Engineering



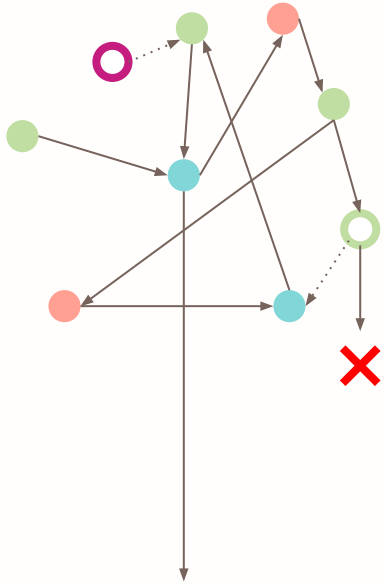
IMPROVED

Machine Learning



IMPROVED

LLM AI Building



??

Let **AI** do it

Human

An **objective instructor**

An AI work **approver**

AI

Handles the actual

DevOps heavy work

of LLM-AI building

Let AI Build AI

Officially unveil the beta of...

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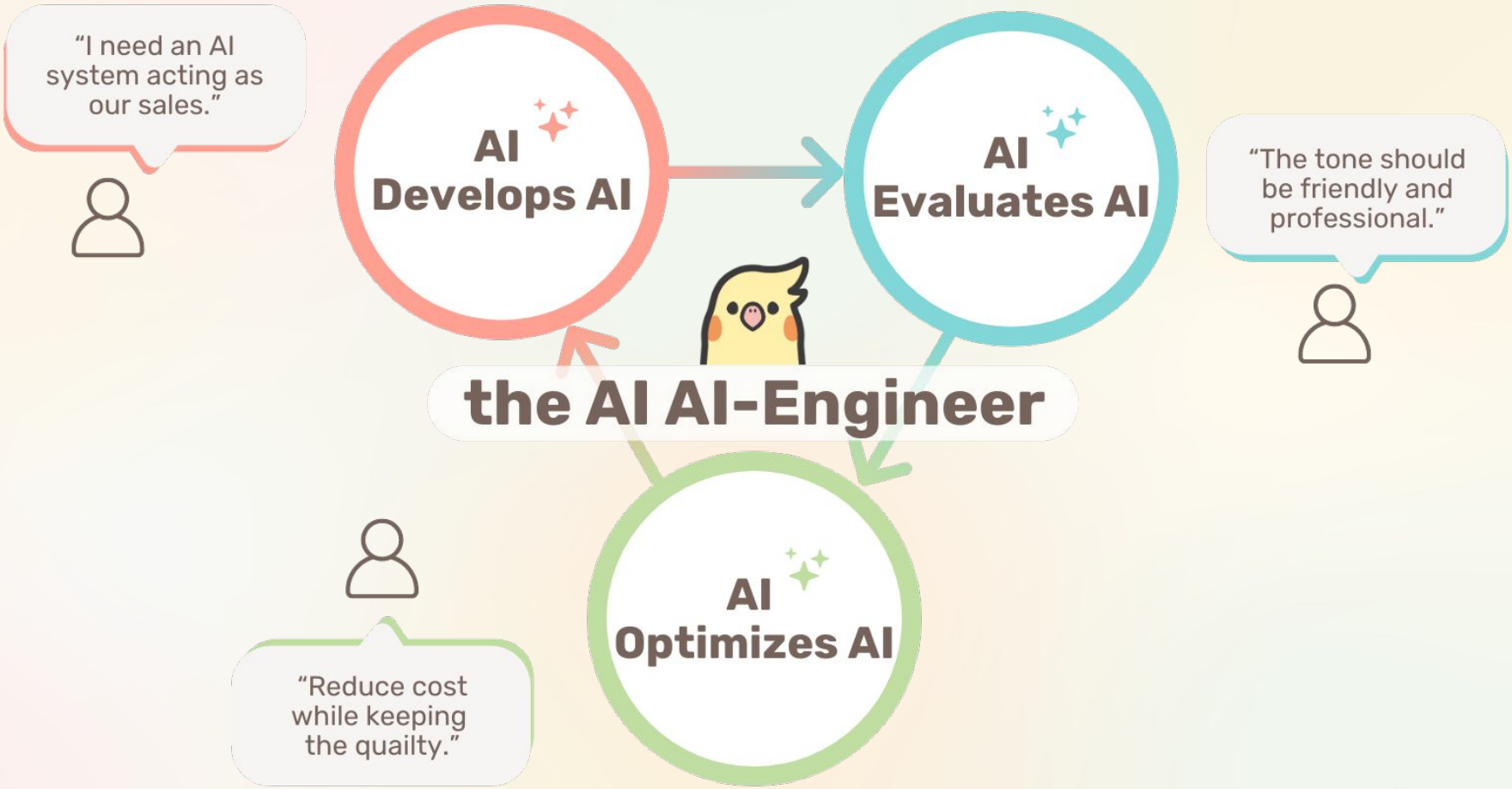
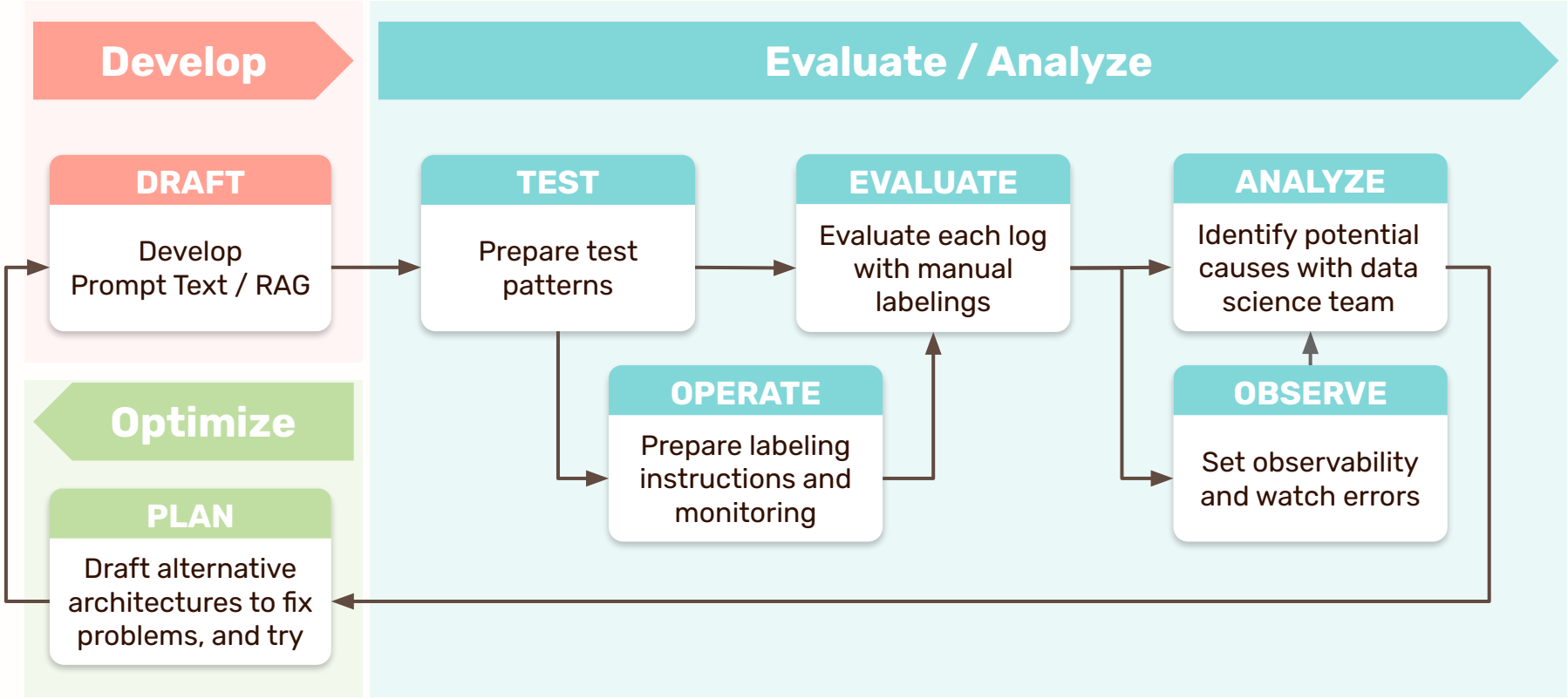
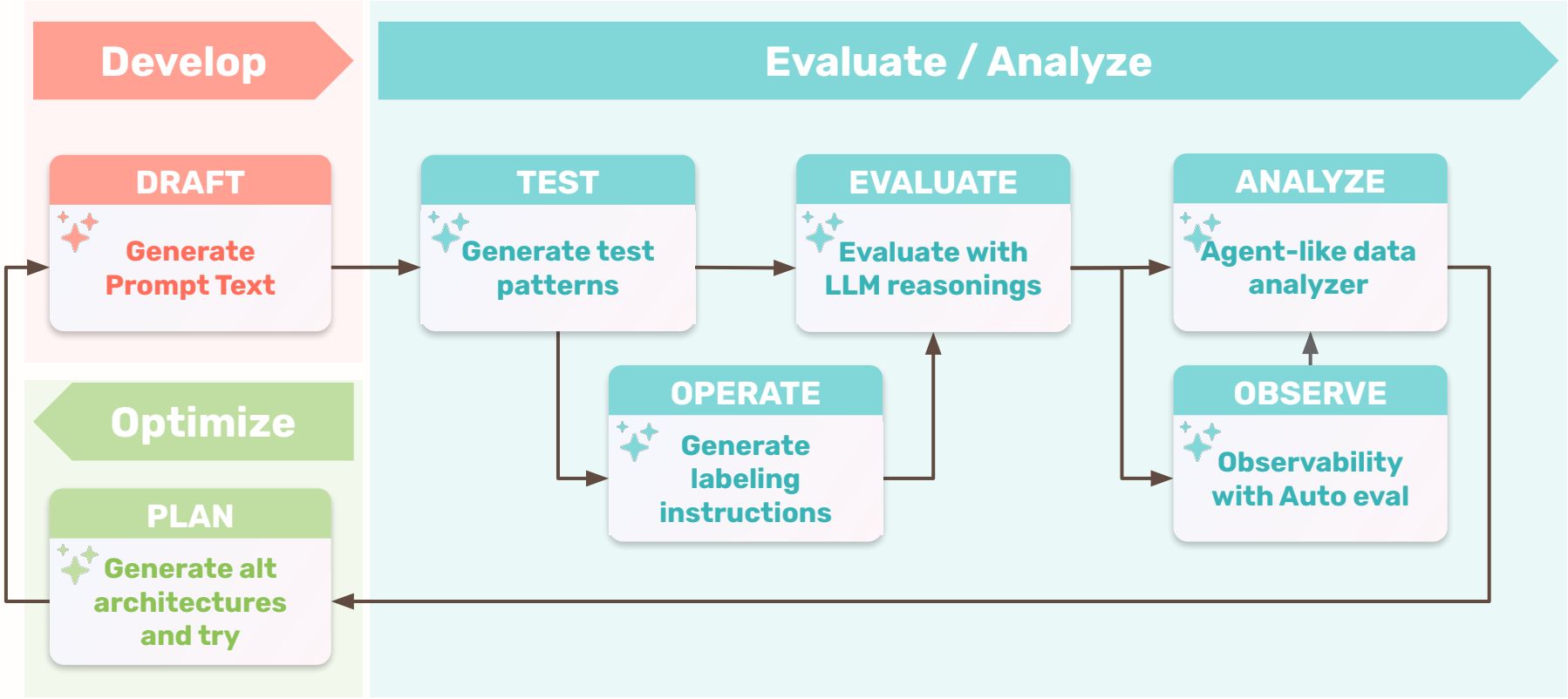
the **AI AI-Engineer**

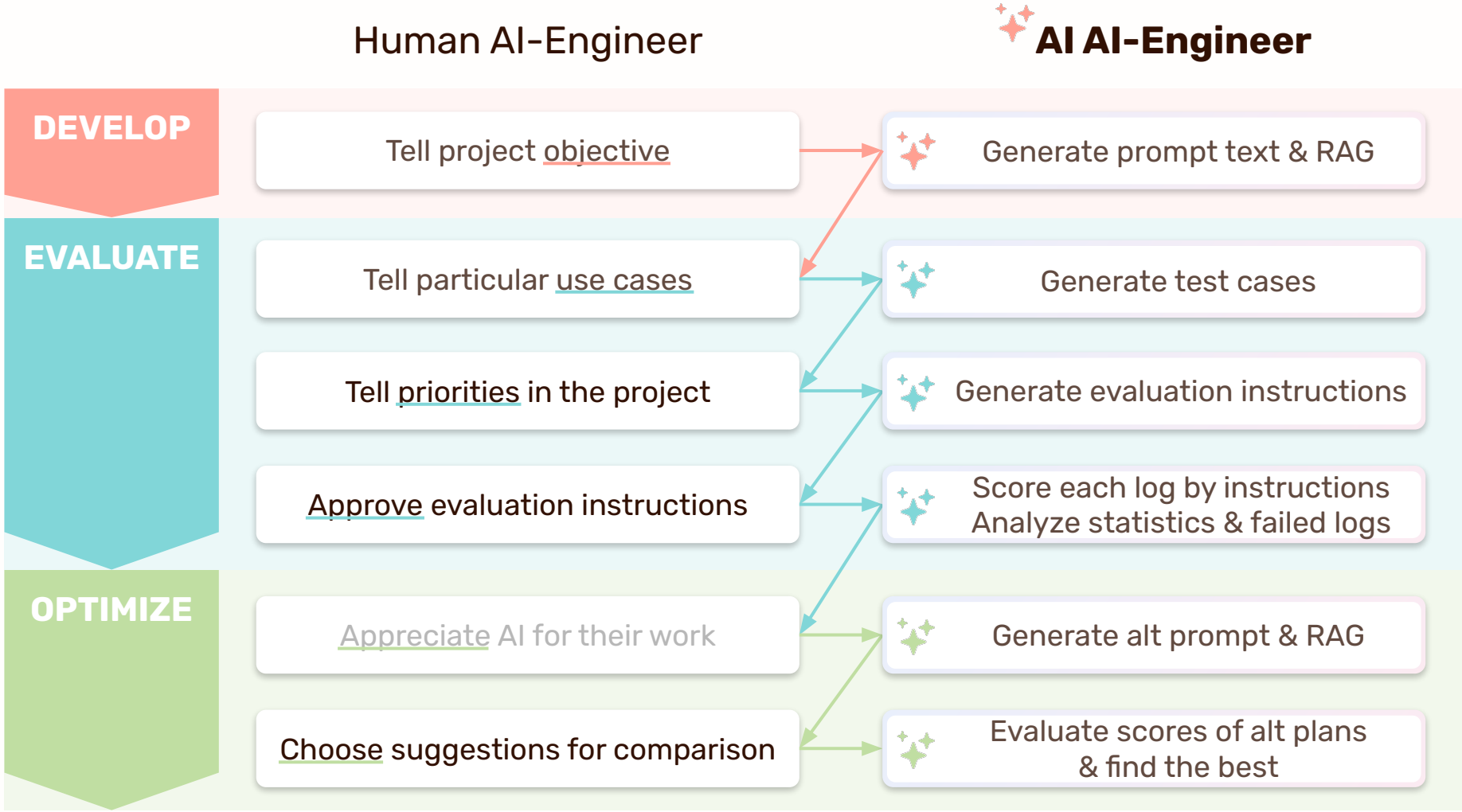

"I need an AI system acting as our sales."
AI Develops AI
AI Evaluates AI
"The tone should be friendly and professional."
the AI AI-Engineer
AI Optimizes AI
"Reduce cost while keeping the quailty."

[Our approach] Teammately AI Agent follows the best practice of LLM iteration cycle



[Our approach] Teammately AI Agent follows the best practice of LLM iteration cycle




Human AI-Engineer
AI AI-Engineer
DEVELOP
Tell project objective
Generate prompt text & RAG
EVALUATE
Tell particular use cases
Generate test cases
Tell priorities in the project
Generate evaluation instructions
Approve evaluation instructions
Score each log by instructions
Analyze statistics & failed logs
OPTIMIZE
Appreciate AI for their work
Generate alt prompt & RAG
Choose suggestions for comparison
Evaluate scores of alt plans
& find the best

Develop / Optimize

Generate AI architecture plan from the available tech stack

Pre-trained Model / Inference

Model choices / Param sizes / Inference choices / Temperature

Prompt Engineering

Prompt Tuning / Chain-of-Thought / Few-shot Learning / Format

RAG / ICL

Chunking patterns / GraphRAG / Reranking / Knowledge Acquisition / Public RAG / kNN Optimization

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Evaluate / Analyze

Generate Tailored LM-as-a-judge

LM checks every log based on the instruction

Latency / Cost Metrics

Statistics Analysis Agent

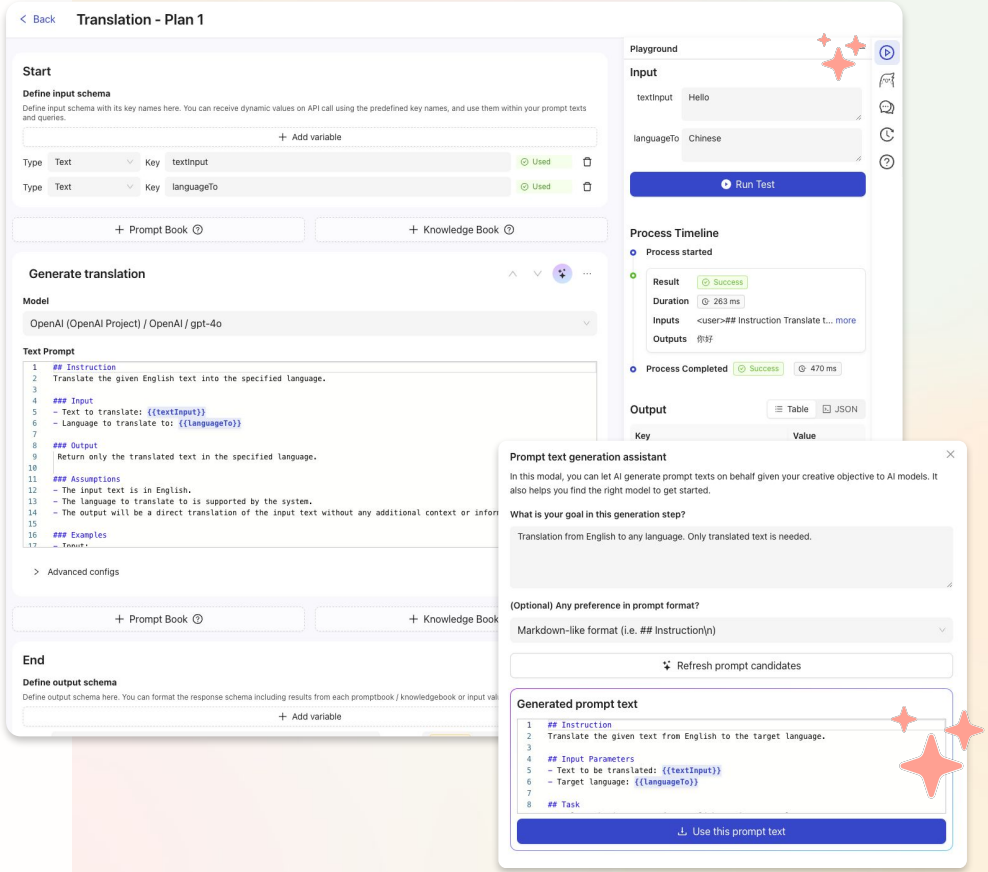
You say LLM is hard to develop and control.

Then **how capable LLM-based Teammately is?**

The AI AI-Engineer Capability

1 Let AI Draft Architecture

You give the first **objective of your project**, then **AI drafts** the initial prompt text and the architecture of LLM.



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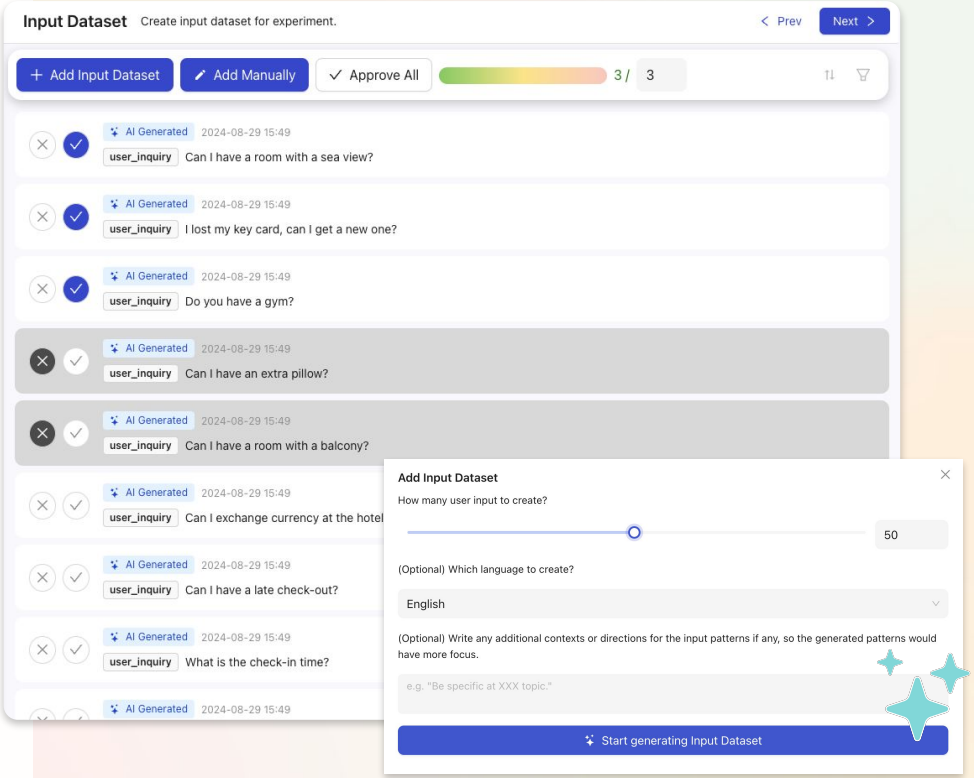
The AI AI-Engineer Capability

2 Let AI Create Test Cases

- ✓ We first need test cases for a consistent evaluation against multiple dev options in LLM architecture.
- ✓ **Our AI generates input text dataset** based on your prompt and generation logics



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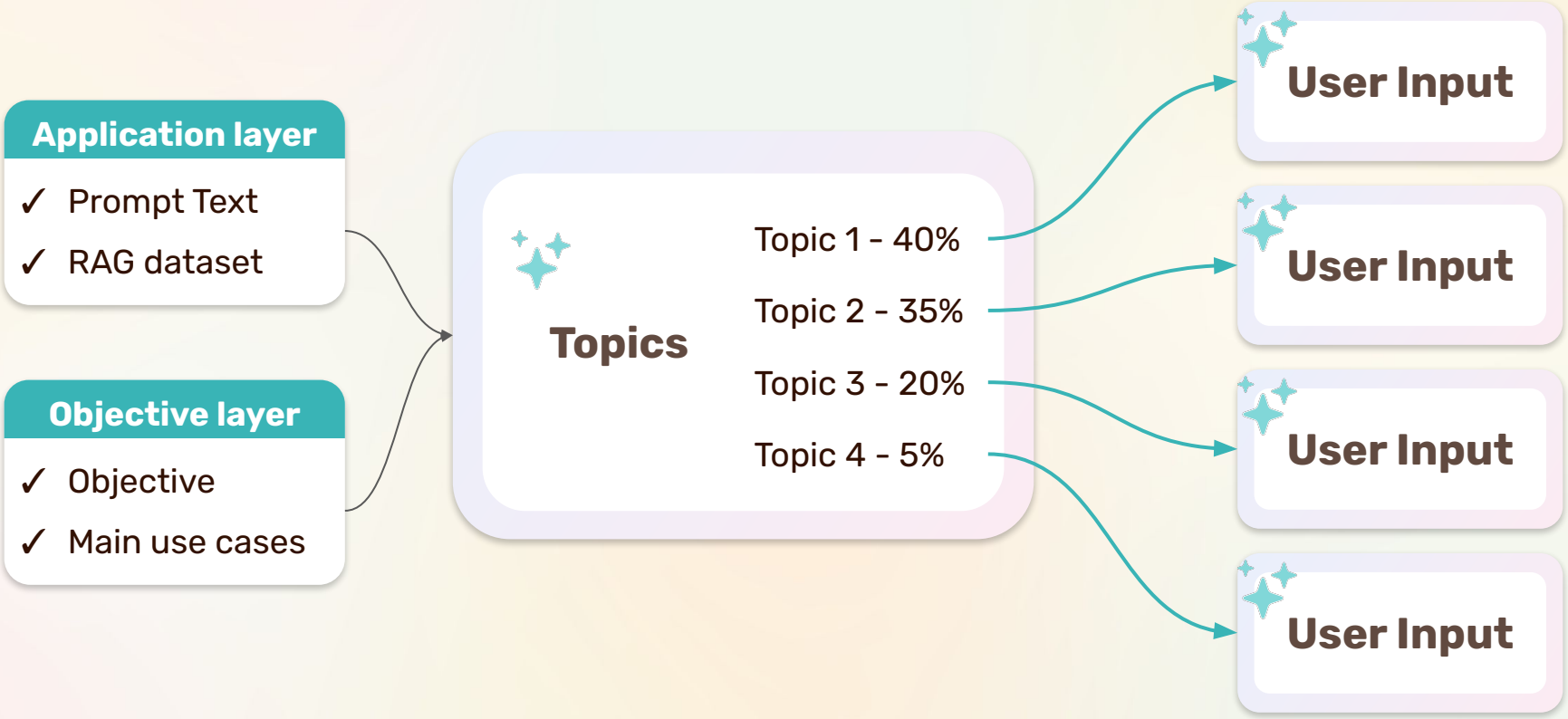
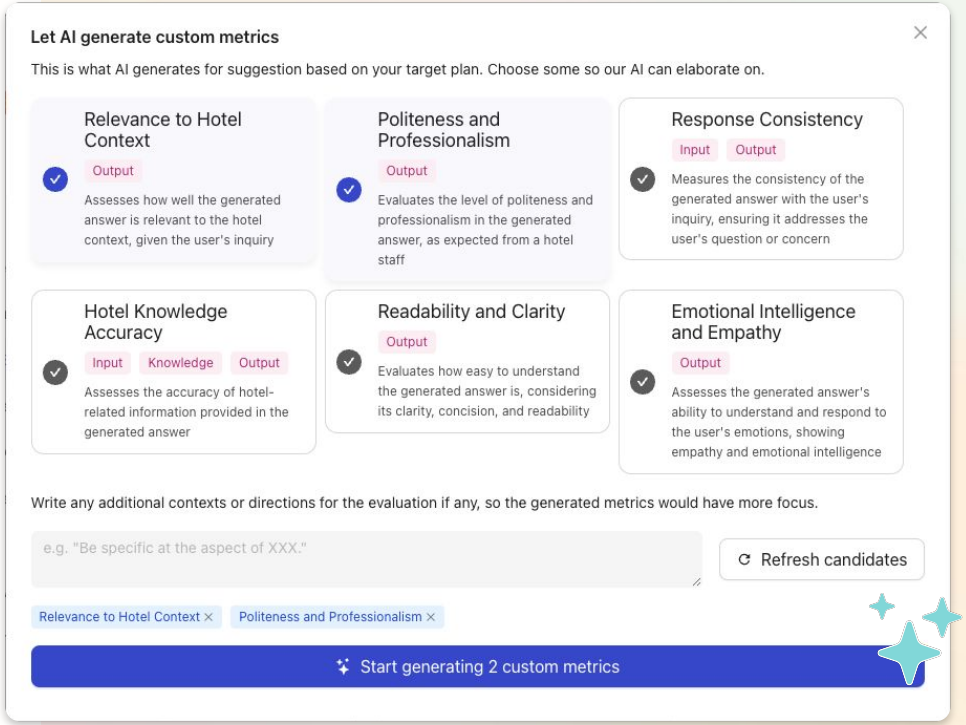
How is our AI building a fair set of test cases? - Basic logic



The AI AI-Engineer Capability

3 Let AI Create Eval Metric

- ✓ **LLM-as-a-judge is an efficient method** to evaluate the quality of LLM responses at large scale, typically far more efficient than traditional human evaluation.
- ✓ **Open-source metrics may not suit every case**. Metrics tailored to each case better fit in evaluating its quality.
- ✓ Our AI creates **custom metrics**.



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3 Let AI Create Evaluation Metrics

Our AI creates custom metrics like:

In Customer Support Agent

- Friendliness
- Politeness
- Helpfulness that goes beyond expectation

In Sales Agent

- Call-to-Action Effectiveness
- Value Proposition Accuracy

Miscellaneous

- Follows the character guideline
- Proper function selection

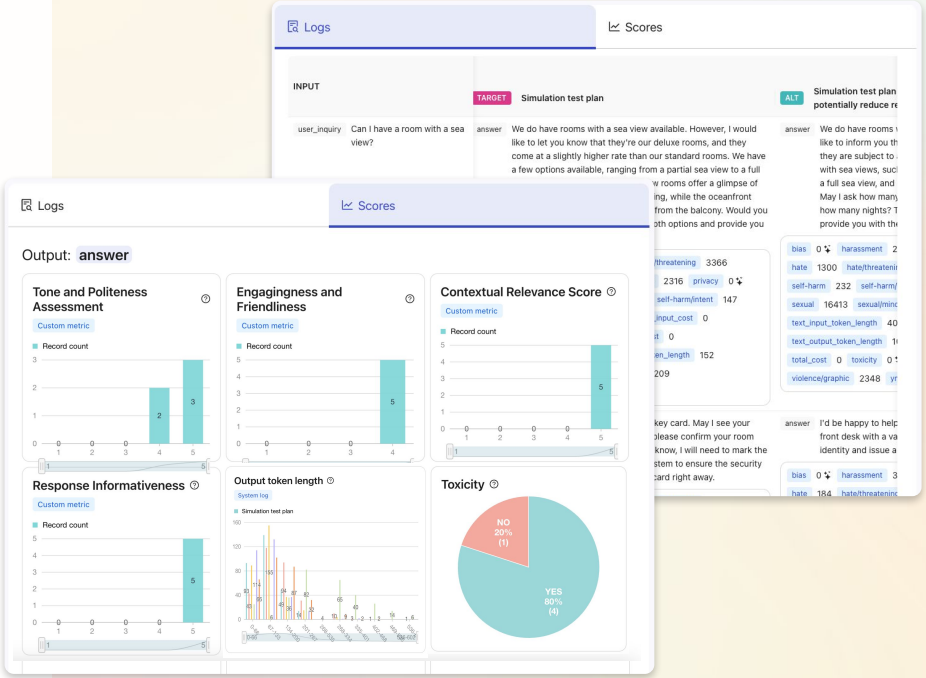
The AI AI-Engineer Capability

4 AI evaluates original plan

Our AI works (like an AI Agent) to…

1. **Simulates** generation outcomes from the generated input test cases
2. **Evaluates** simulated logs based on the generated metric instructions
3. **Analyzes** the evaluation results quantitatively and qualitatively
   Results are visualized for human reviewers
4. **Summarizes** the analysis results to construct a problem narrative, forming the basis for alt planning strategies

…WAIT FOR 3 MINS

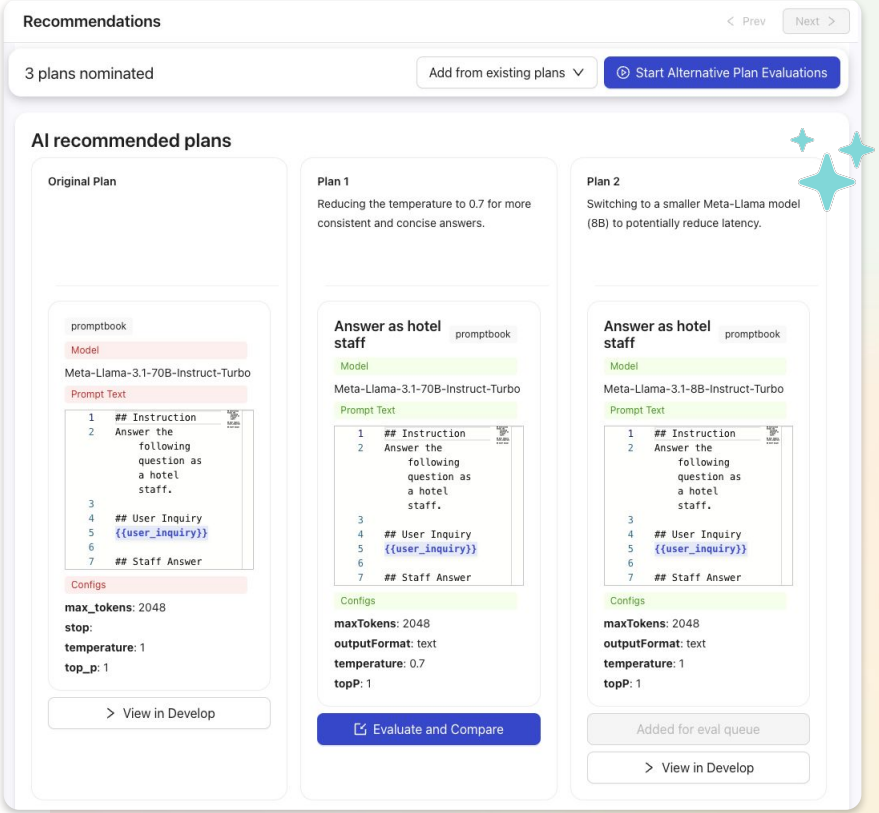


The AI AI-Engineer Capability

5 Review alternative plans

Based on the analysis, AI operates:

- ✓ LLM architecture improvement suggestions
- ✓ Missing knowledge identification to fulfill



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4 AI evaluates original plan

We generally have below average performance in familiarity, while the accuracy of answer is perfect.

We have less accuracy scores in topic of refund, due to lack of information in RAG dataset.

5 Review alternative plans

Prompt

Add more rules in prompt while prettiering format

AI model

Switch to XXX model, strong at casual chat, to improve familiarity

RAG

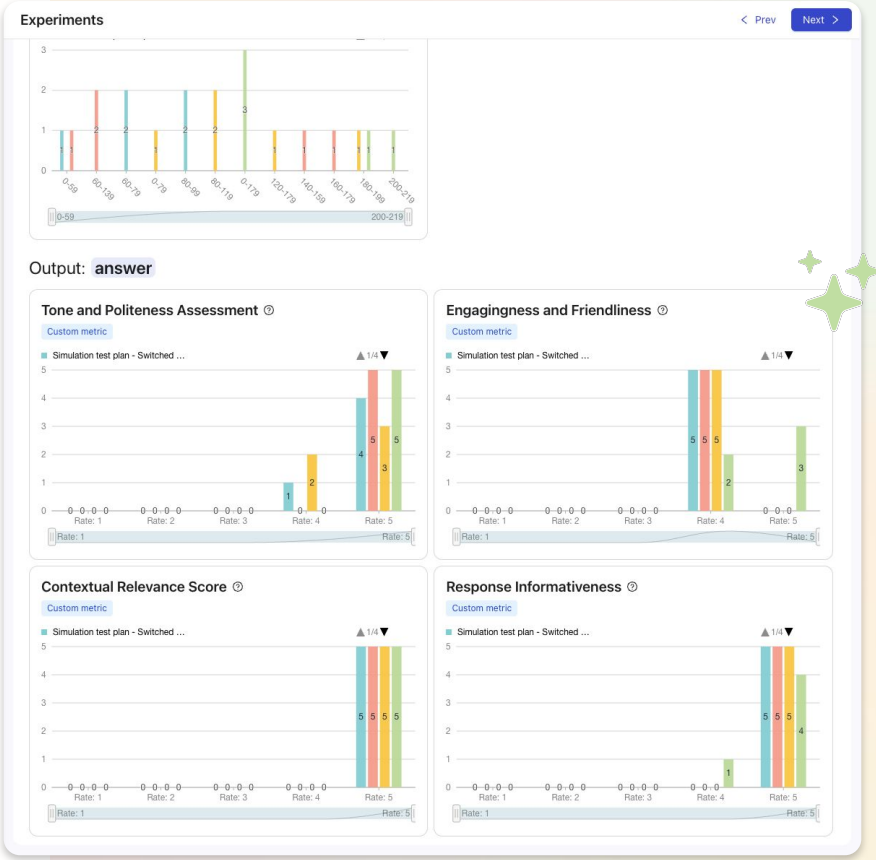
Add more knowledge in refund topic to reduce failure rate

The AI AI-Engineer Capability

6 AI Evaluates Alt Plans

- ✓ AI evaluates alt plans again after human review.
- ✓ After evals, our Agentic AI aggregates score and compare which plan performs better than the others in each metric.

...WAIT FOR 10+ MINS



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The AI AI-Engineer Capability

7 AI Judges Final Rankings

✓ As the final step, AI creates overall narrative from data report and judges the final rankings of each plan, to help guiding the the best balanced one among candidates.

Conclusions < Prev Next >

Final rankings judged by AI

1 ALTERNATIVE **Simulation test plan - Modified the prompt text to create more engaging and friendly responses.** Marked as the best

Reason: This plan excels in "Engagingness and Friendliness" with an average score of 4.6 and achieves a perfect score of 5 in "Tone and Politeness Assessment" while maintaining high scores in "Response Informativeness" and "Contextual Relevance Score". Although this plan has longer input, output, and total token lengths leading to higher latencies, these factors are less prioritized compared to the significant improvement in user interaction quality. The balance between friendliness, politeness, and informativeness makes this plan highly practical for a hotel-related application.

Avg. Scores: latency 4710.4 | text_input_cost 0 | text_input_token_length 50 | text_output_cost 0 | text_output_token_length 146.4 | text_total_token_length 196.4 | total_cost 0 | Tone and Politeness Assessment 5 | Engagingness and Friendliness 4.6 | Contextual Relevance Score 5 | Response Informativeness 4.8

2 ORIGINAL **Simulation test plan** Mark as the best

Reason: This plan consistently performed well across most metrics, offering the lowest average latency (3580.2 ms) and balanced token lengths. It also scored perfectly in both "Response Informativeness" and "Contextual Relevance Score". The stable performance in all evaluation metrics without significant downsides places this plan at a high rank. Despite not leading in engagement and friendliness as much as the top plan, it provides a solid balance of efficiency and quality.

Avg. Scores: latency 3580.2 | text_input_cost 0 | text_input_token_length 41 | text_output_cost 0 | text_output_token_length 113.2 | text_total_token_length 154.2 | total_cost 0 | Tone and Politeness Assessment 4.6 | Engagingness and Friendliness 4 | Contextual Relevance Score 5 | Response Informativeness 5

3 ALTERNATIVE **Simulation test plan - Switched to a smaller model from the same provider to reduce response latency.** Mark as the best

Reason: This plan demonstrated a relatively good performance with the second-lowest average latency (4439.8 ms). It maintains high scores in "Response Informativeness" and "Contextual Relevance Score" while having the shortest input token length, contributing to efficient processing. Although this plan is slightly behind in terms of engagement and friendliness, it remains a viable option due to its balanced performance and lower latency.

Avg. Scores: latency 4439.8 | text_input_cost 0 | text_input_token_length 40 | text_output_cost 0 | text_output_token_length 101.6 | text_total_token_length 141.6 | total_cost 0 | Tone and Politeness Assessment 4.8 | Engagingness and Friendliness 4 | Contextual Relevance Score 5 | Response Informativeness 5

4 ALTERNATIVE **Simulation test plan - Split the single response step into two for better focus and potentially quicker response generation.** Mark as the best

Reason: While this plan excels in output token length and total token length, managing these efficiently, it suffers from significantly higher latency (average of 9769.4 ms), which can negatively impact user experience. Despite strong scores in "Response Informativeness" and "Contextual Relevance Score", the high latency is a considerable drawback. This performance bottleneck makes this plan less preferable compared to others, especially given that user experience can degrade with longer wait times.

Avg. Scores: latency 9769.4 | text_input_cost 0 | text_input_token_length 46 | text_output_cost 0 | text_output_token_length 68.2 | text_total_token_length 114.2 | total_cost 0 | Tone and Politeness Assessment 5 | Engagingness and Friendliness 4 | Contextual Relevance Score 5 | Response Informativeness 5

AI Analysis

Latency (ms)
Takeaway: Response latency is crucial for user experience.
- **Best Plan:** "Simulation test plan" with an average latency of 3580.2 ms indicates the fastest response generation, followed by "Simulation test plan - Switched to a smaller model from the same provider" with 4439.8 ms.
- **Observation:** Splitting response steps ("Simulation test plan - Split the single response step") and modifying prompt text ("Simulation test plan - Modified the prompt text") show significantly higher latencies.

Total Cost (USD)

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The AI AI-Engineer Capability - Case Study

Project objective

Build a **Customer Success Agent** that ensures high satisfaction and seeks upselling opportunities when possible

Original architecture

- Uses **a single prompt text that includes all required instructions**
- Uses **gpt-4o**

Generated eval metrics

1. **Helpfulness** to user inquiry as a Customer Success
2. **Relevance** of Upselling Opportunities to User Inquiries
3. **CTA** Effectiveness
4. Follows company **Compliance**

Final architecture judged as the best

- ✓ **Decomposes generation into multiple steps**, including analysis of user intent and potential upselling opportunities
- ✓ **Uses Llama-3.1-405B** hosted on XXX inference.
- ✓ For each **knowledge document** in the corpus, **adds context and use-case scenarios along with product information**, in order to improve the hit rate

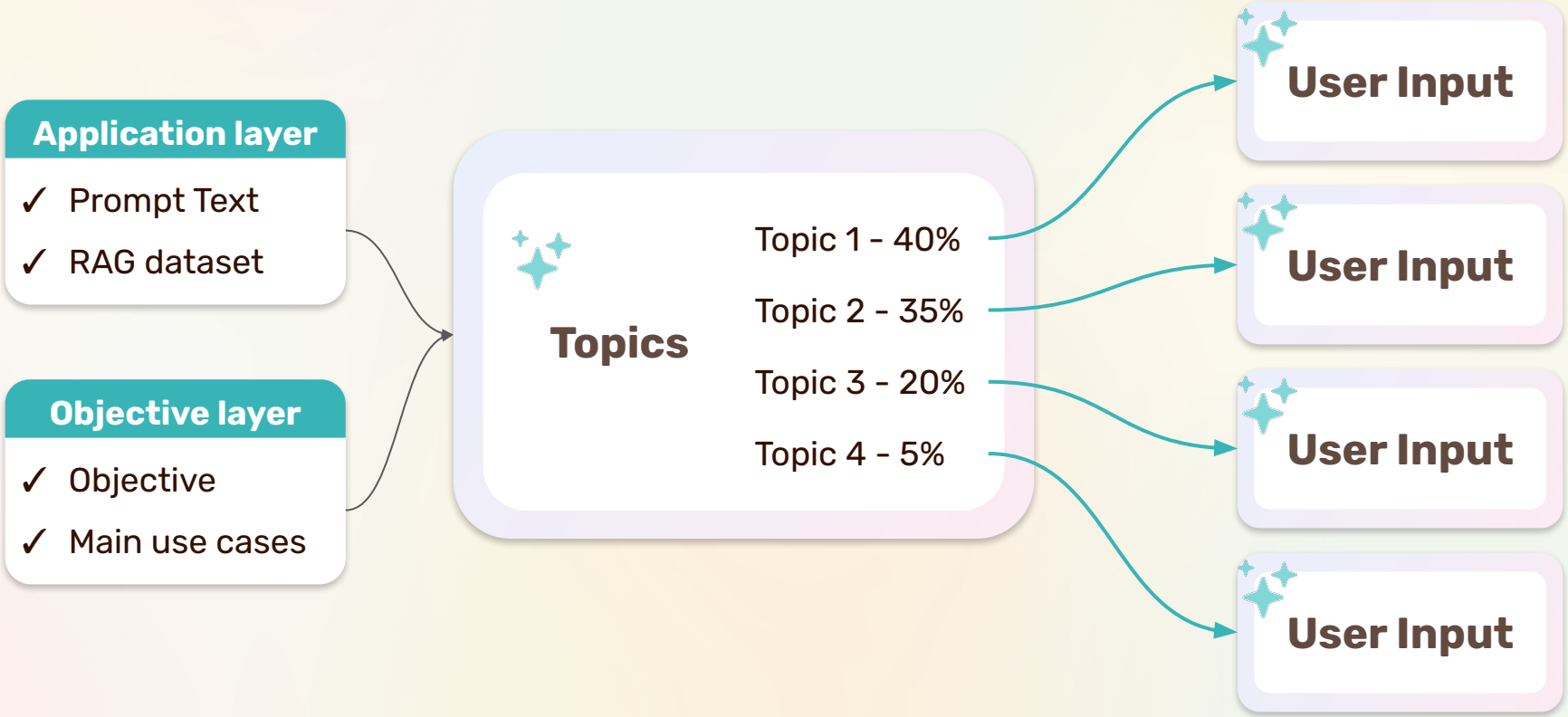
The AI AI-Engineer Capability - Case Study

LLM-based AI on Teammately are being iterated on Teammately

Prompt & Architecture Generator	Input Dataset Generator	Platform-prepared LLM-as-a-judge	Alternative LLM Architecture Proposer
LLM-as-a-judge Evaluator Generator	Statistical Data Analyzer	Missing Knowledge Identifier	Final Ranking Judge

The AI AI-Engineer Capability - Case Study

The idea to separate into multiple steps are first initiated by our AI, with a statistical proof to work better in many cases.



The AI AI-Engineer Capability - Case Study

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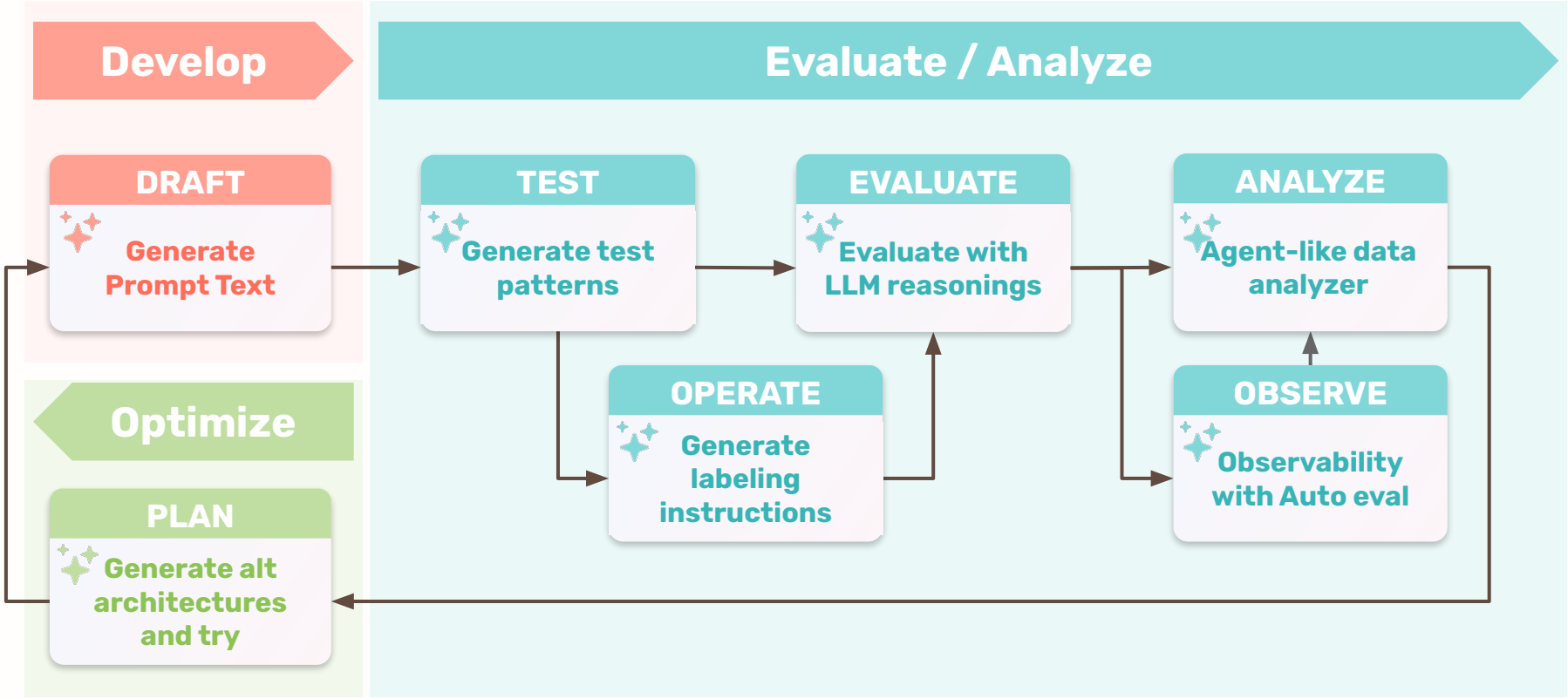
LLM-as-a-judge Evaluator Generator	Statistical Data Analyzer	Missing Knowledge Identifier	Final Ranking Judge

We're sure our capability will even get improved with using Teammately

Teammately

[Our approach] "Deep Iteration" with the automated architecture improvement



How it brings a success to your R&D

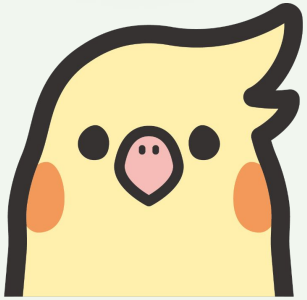
SAVES **37.5** hours / iteration × # of iterations

PROD Requirements

Scaled Testing & Consistent Quantification

NOT FEASIBLE to do **manually**

AI AI-Engineer can do them



Teammately

the **AI AI-Engineer**

Let AI Build AI