



Gen AI for Software Development





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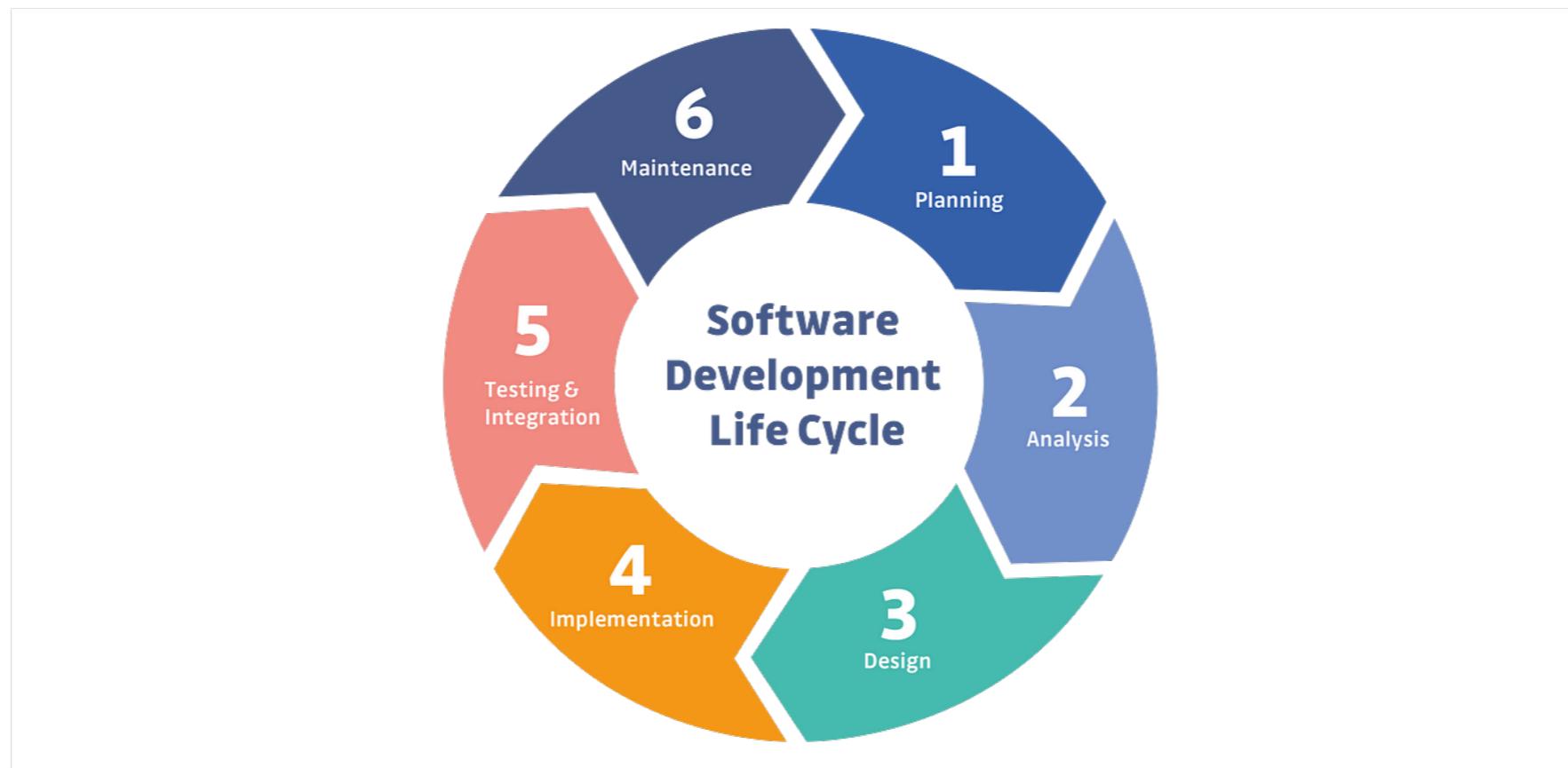


**[https://github.com/up1/
workshop-ai-with-technical-team](https://github.com/up1/workshop-ai-with-technical-team)**



Goals

Integrate Generative AI in Software Development
Optimize code quality
Team up with AI on coding tasks
Develop innovative solutions



Software Development

Requirement

Design

Develop

Testing

Deploy

Generative AI

Improve Productivity ... (Replace human !!)



Learning Path

AI/ML

AI Model

Prompt Engineer

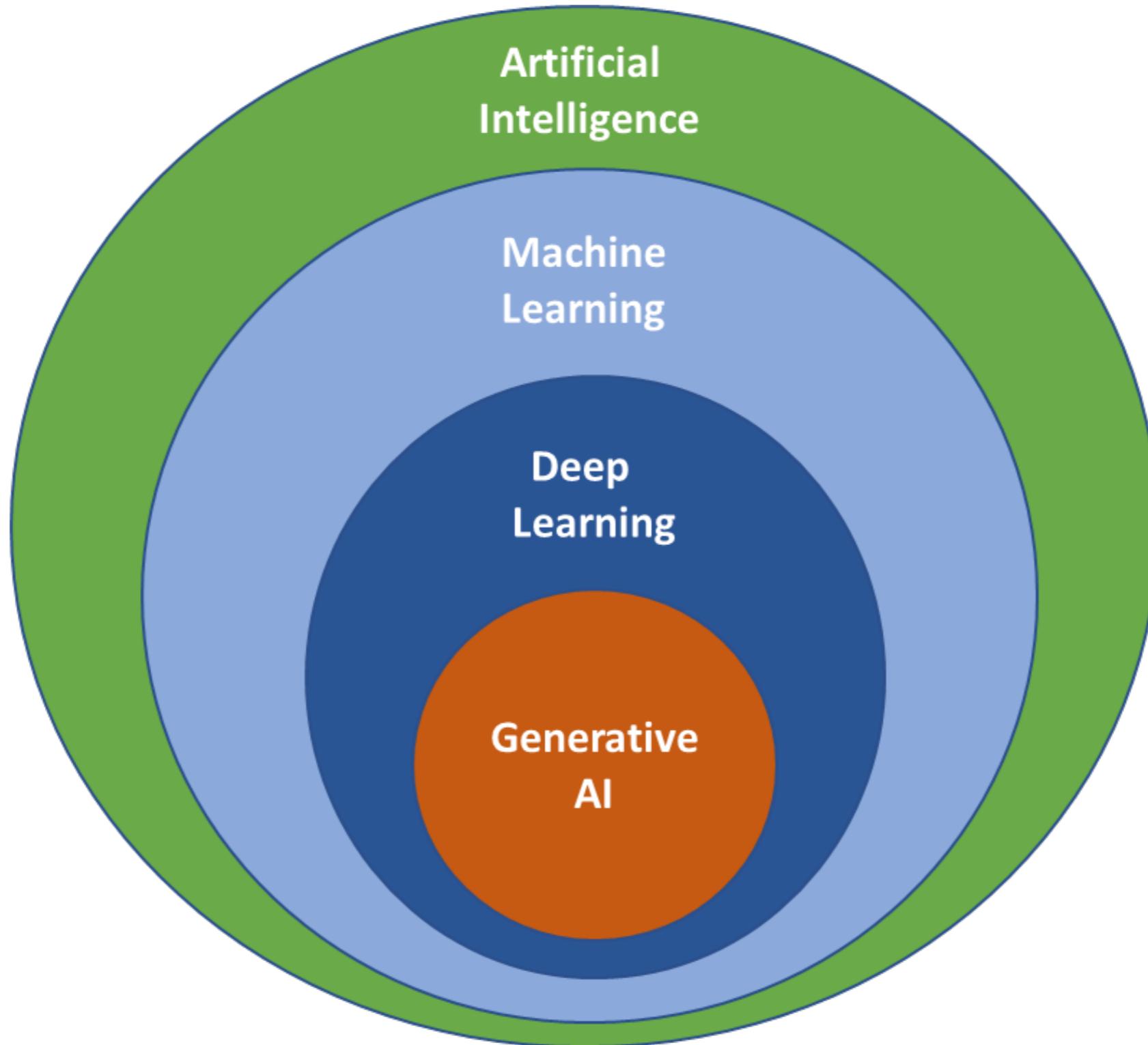
AI in Software development

Develop AI/LLM app

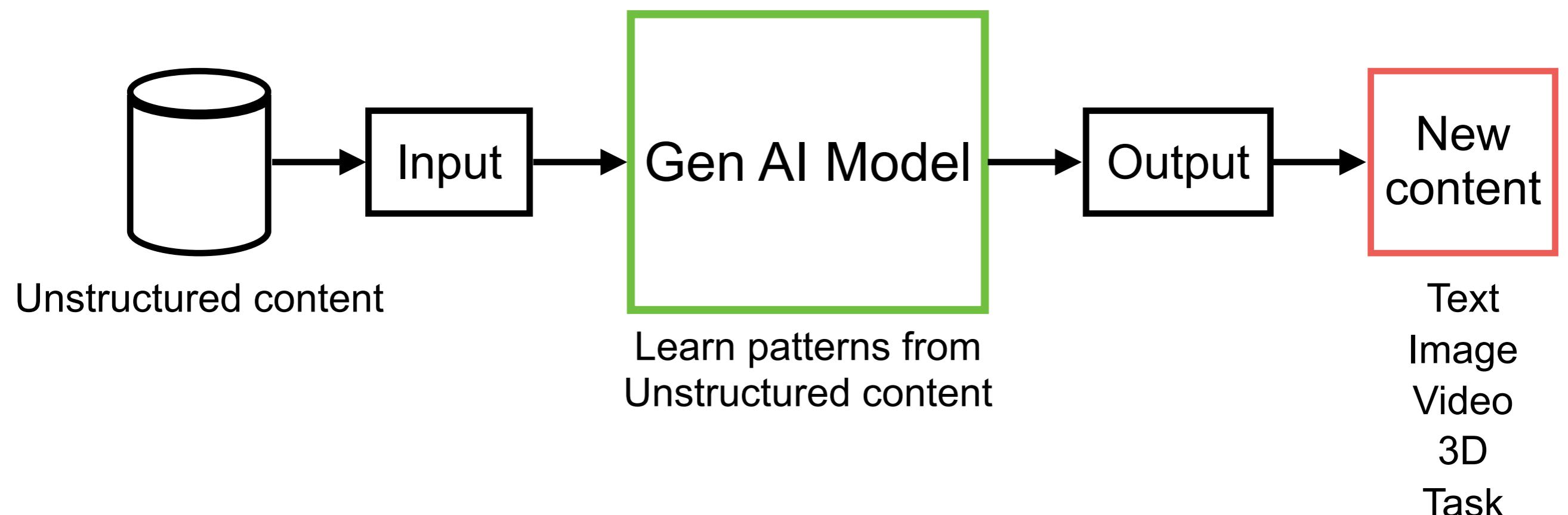
RAG

Use cases and workshops





Generative AI



<https://grow.google/ai-essentials/>



Generative AI

LLMs

Large Language Models

Text generation

Code generation

Chatbot

Conversation AI

GANs

Generative Adversarial Network

Image generation

Deep fake

Art creation

Simulate financial market

VAEs

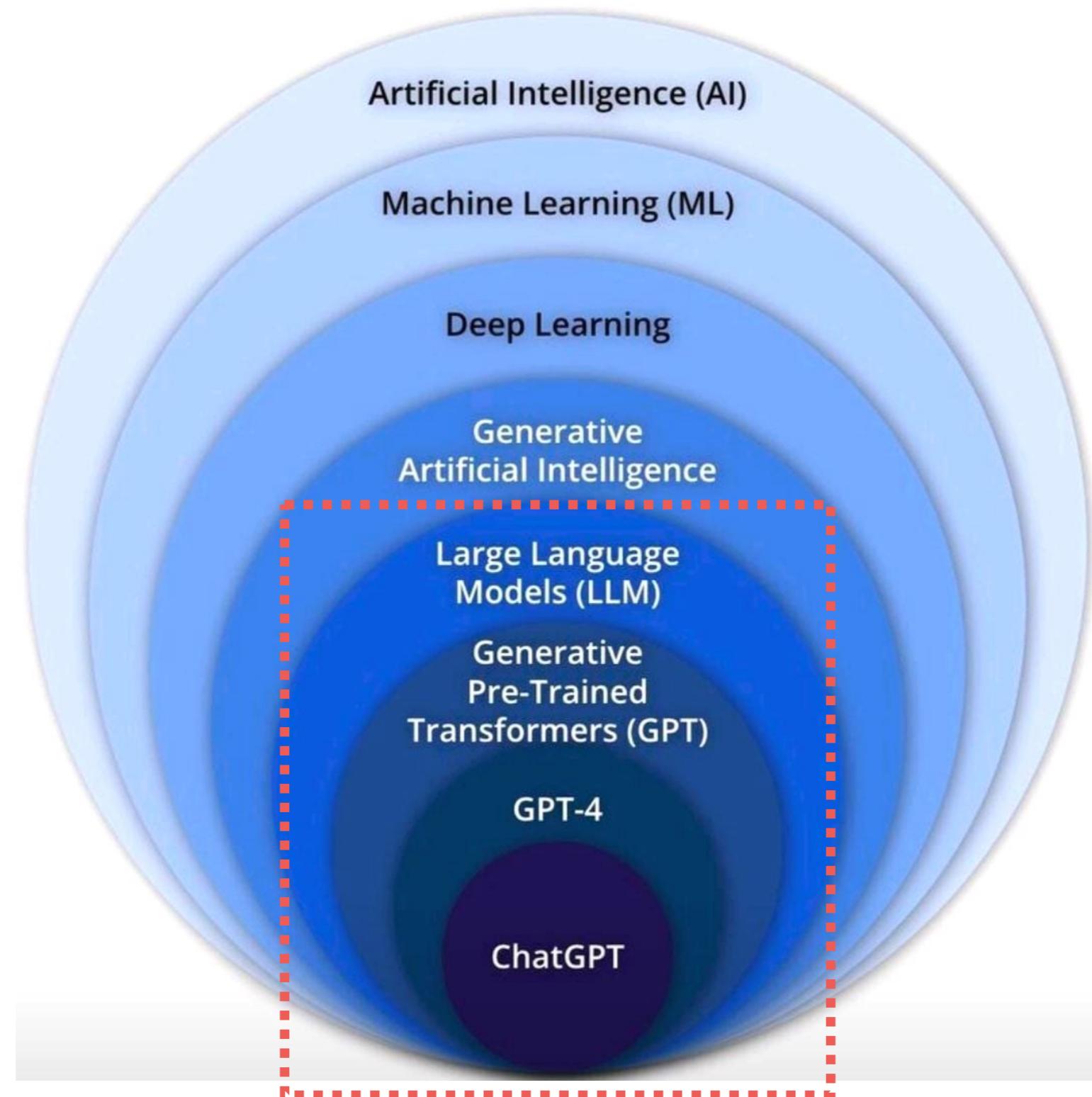
Variational Autoencoders

Data compression

Synthetic data generation

Image reconstruction





Large Language Model (LLM)

Type of AI model

Process, understand

Generate human readable data

LLM

Training data !!



LLMs in industry

Model name	Company
Bidirectional Encoder Representation from Transformers (BERT)	Google AI
Generative Pre-trained transformer-5 (GPT-5)	OpenAI
Pathways Language Model-E (PaLM-E)	Google AI
BLOOM	NVIDIA AI
Llama 4	Facebook
Claude 4.5 Sonnet	Anthropic



LLM Development timeline

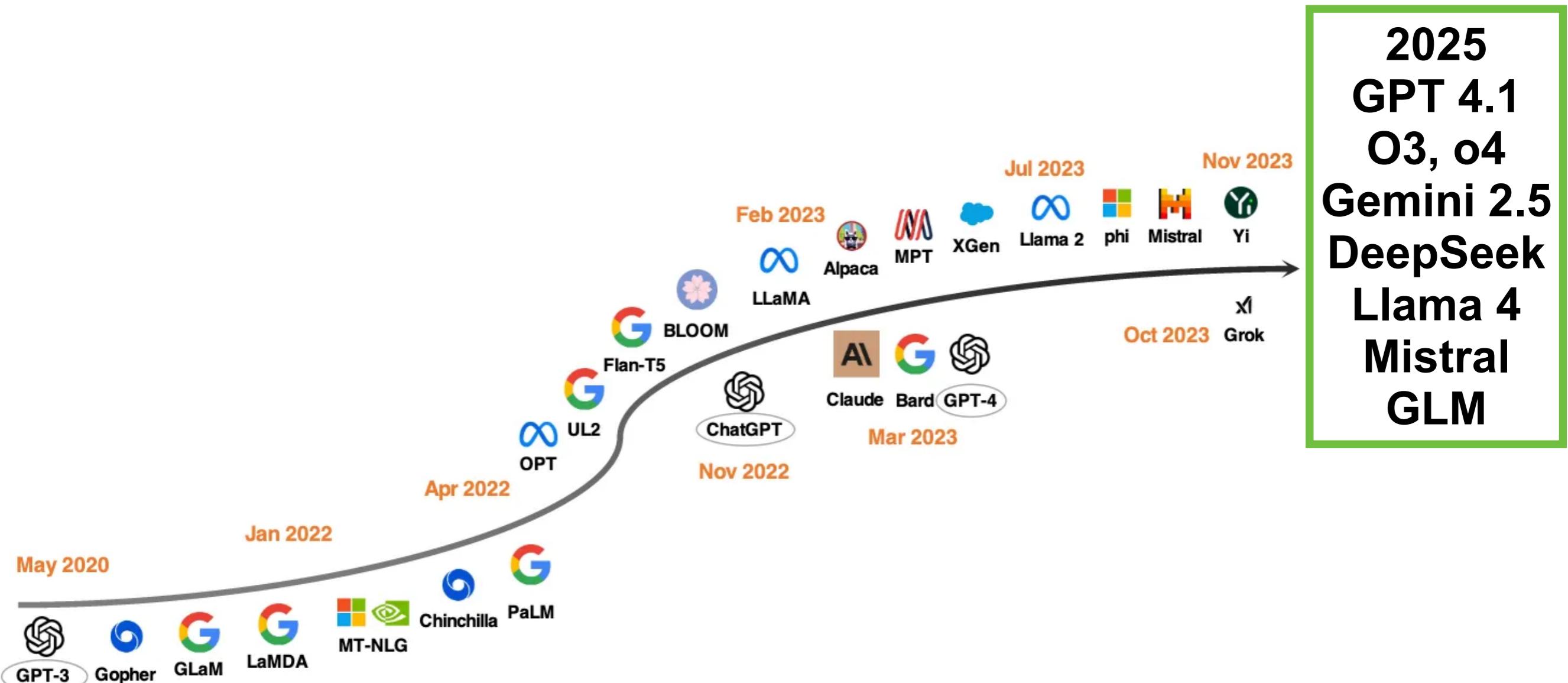


Figure 3: LLM development timeline. The models below the arrow are closed-source while those above the arrow are open-source.

<https://arxiv.org/abs/2311.16989>



Let's go !!



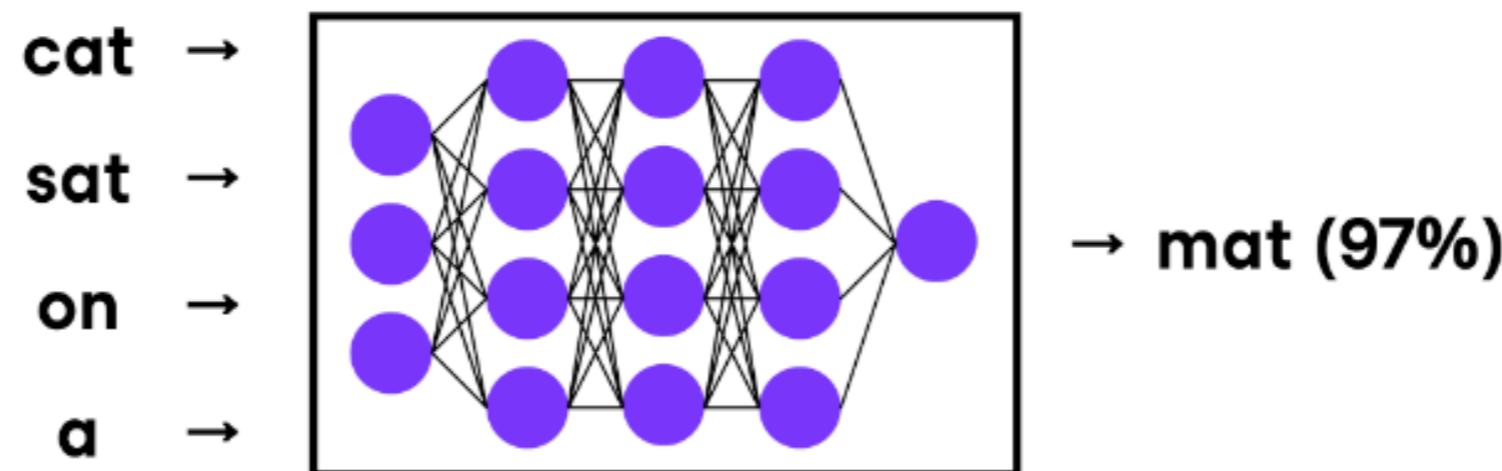
ສືເໜືອງ



Large Language Model (LLM)

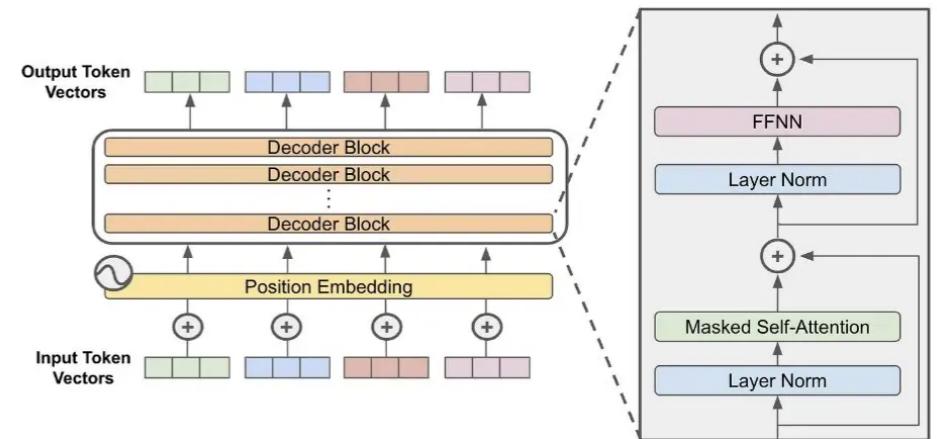
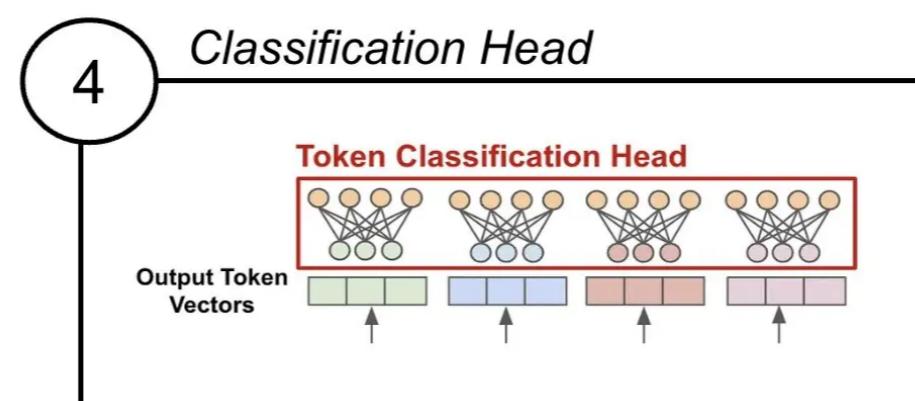
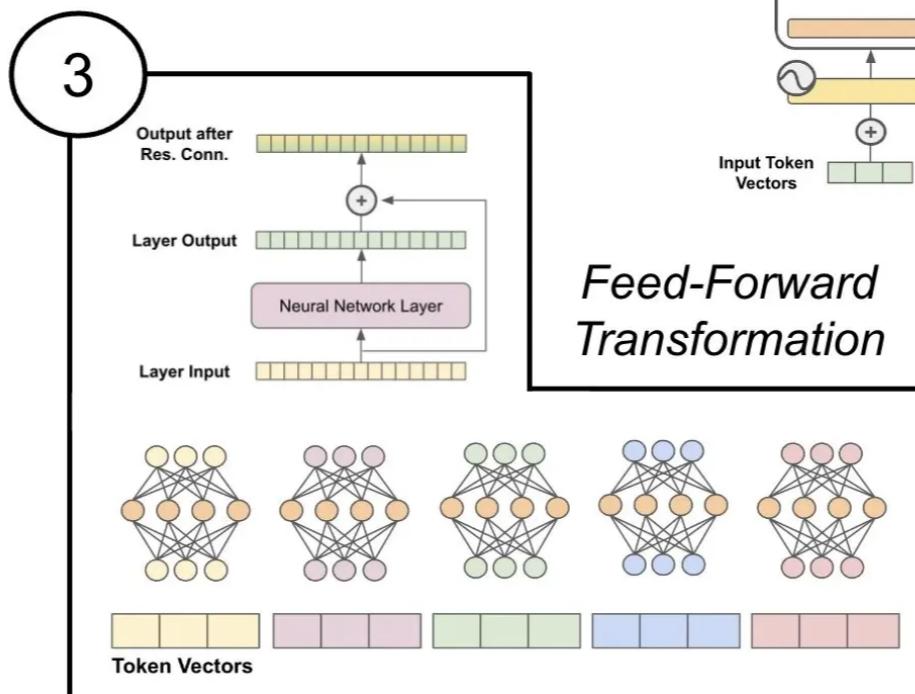
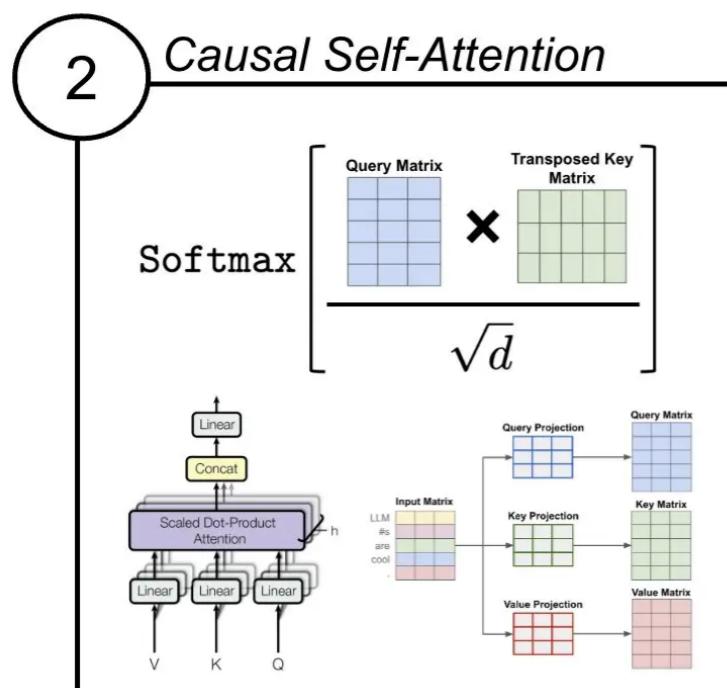
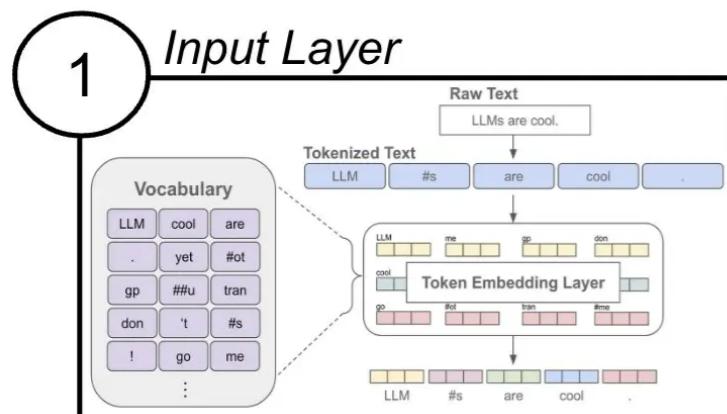
Neural network

Predicts the next word in a sequence



LLM components !!

Components of the Decoder-only Transformer



4 *Transformer Block*

```

from torch import nn
class Block(nn.Module):
    def __init__(self,
                 d,
                 H,
                 T,
                 bias=False,
                 dropout=0.2,
                 ):
        ...
        d: size of embedding dimension
        H: number of attention heads
        T: maximum length of input sequences (in tokens)
        bias: whether or not to use bias in linear layers
        dropout: probability of dropout
        ...
        super().__init__()
        self.ln_1 = nn.LayerNorm(d)
        self.attn = CausalSelfAttention(d, H, T, bias, dropout)
        self.ln_2 = nn.LayerNorm(d)
        self.ffnn = FFNN(d, bias, dropout)

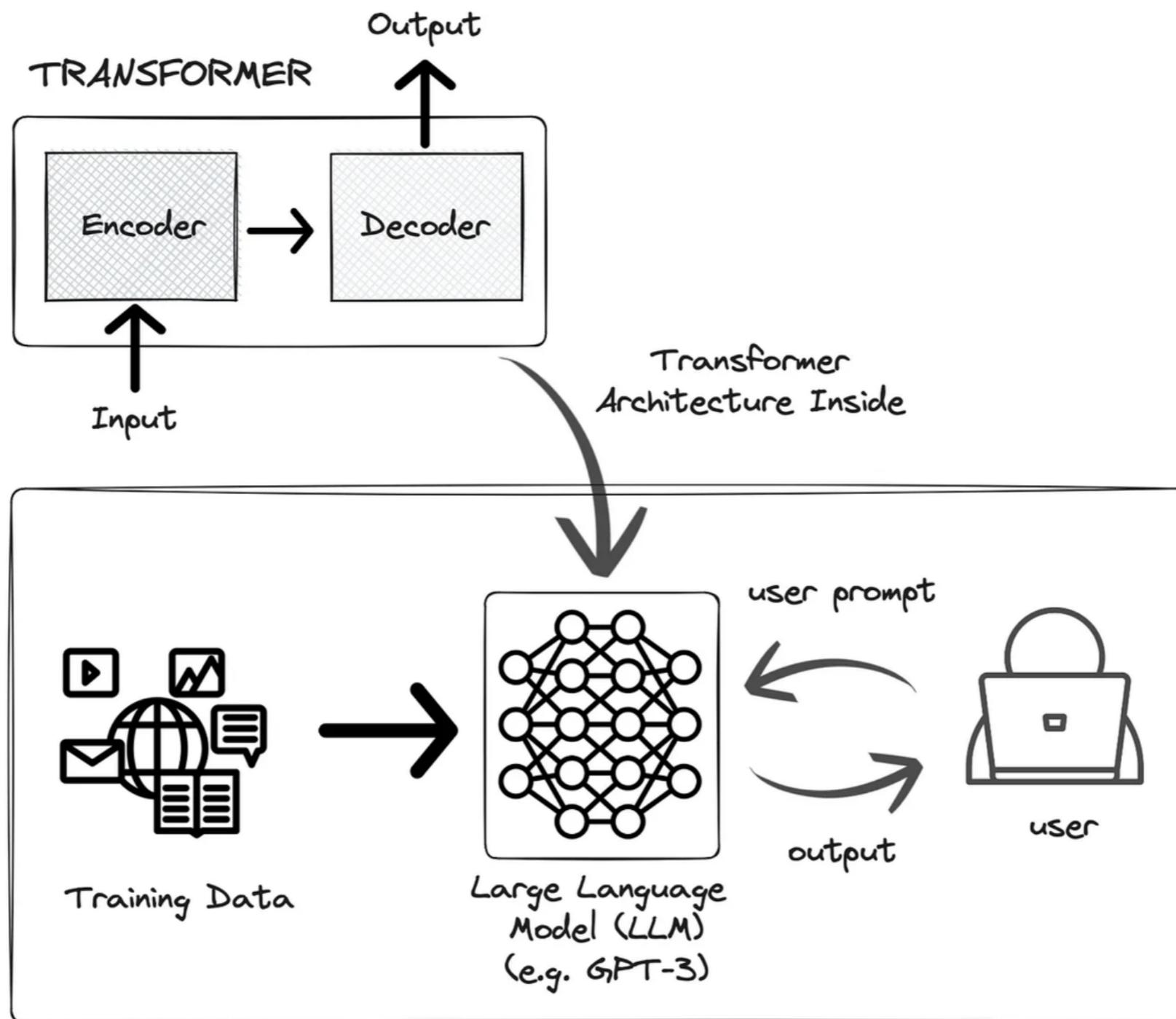
    def forward(self, x):
        x = x + self.attn(self.ln_1(x))
        x = x + self.ffnn(self.ln_2(x))
        return x

```

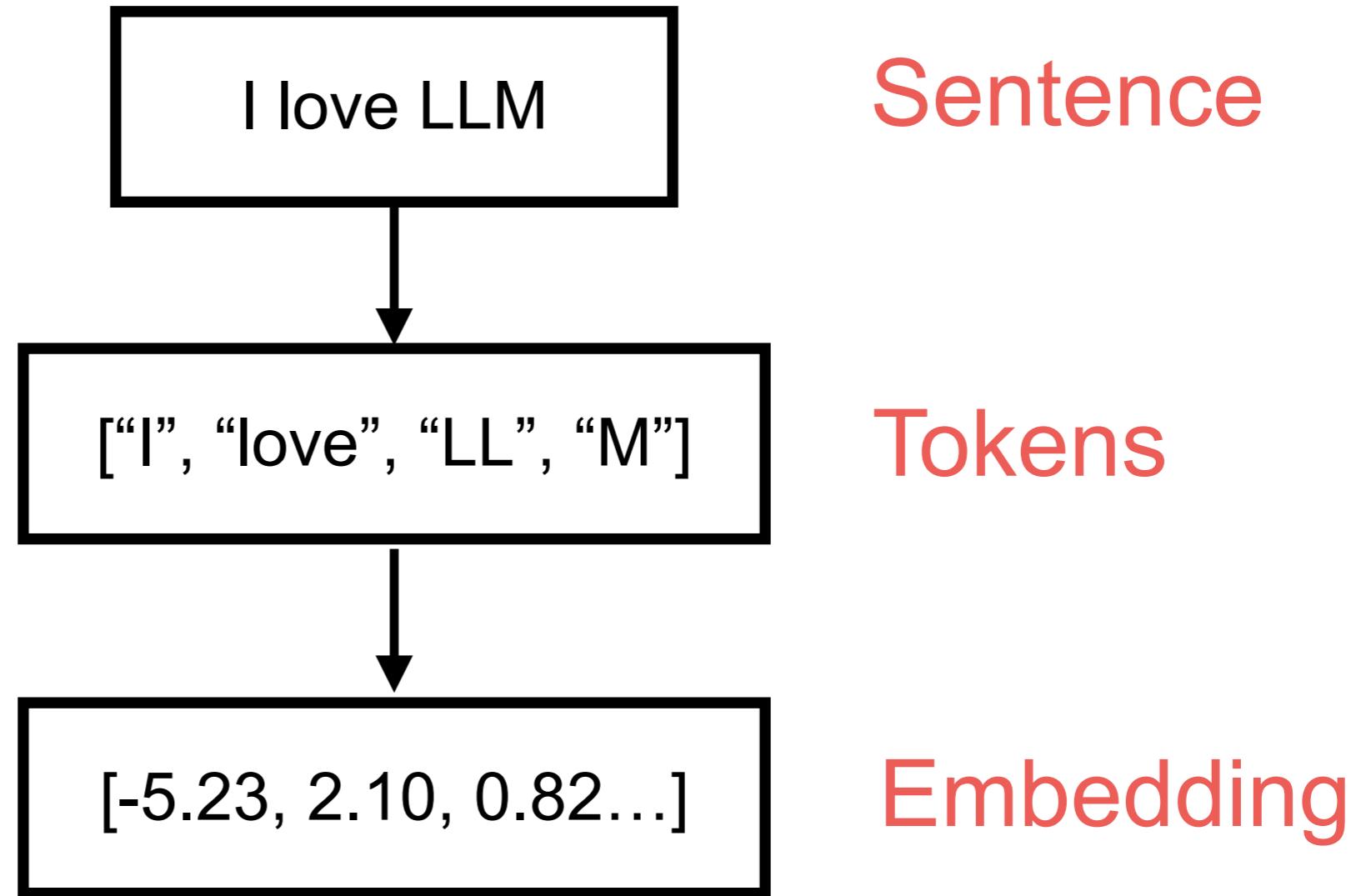
<https://stackoverflow.blog/2024/08/22/lms-evolve-quickly-their-underlying-architecture-not-so-much>



Transformer inside



Transformer process



OpenAI Tokenizer

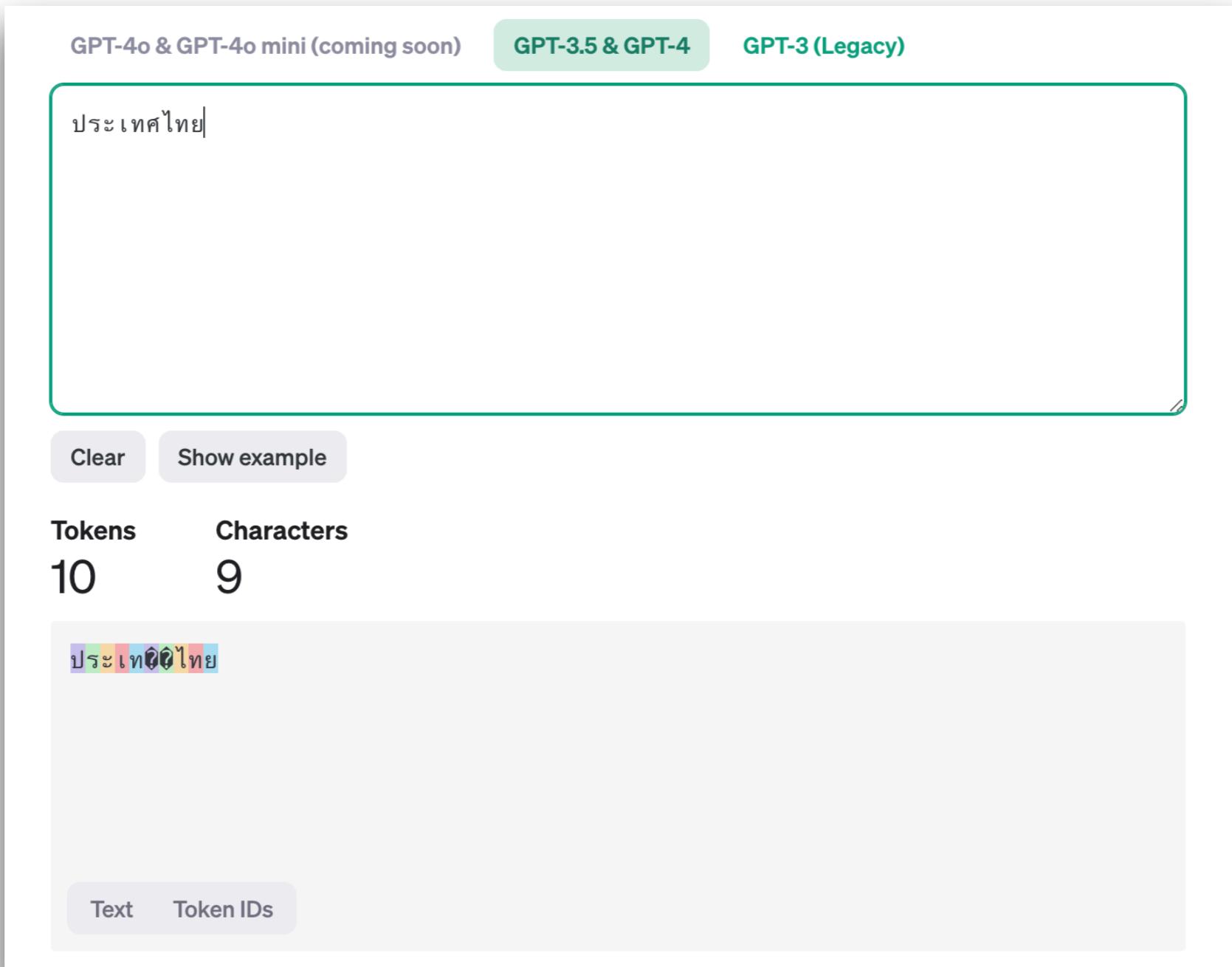
GPT-4o & GPT-4o mini (coming soon) **GPT-3.5 & GPT-4** GPT-3 (Legacy)

ประเทศไทย

Tokens **Characters**
10 9

ประเทศไทย

Text **Token IDs**



<https://platform.openai.com/tokenizer>

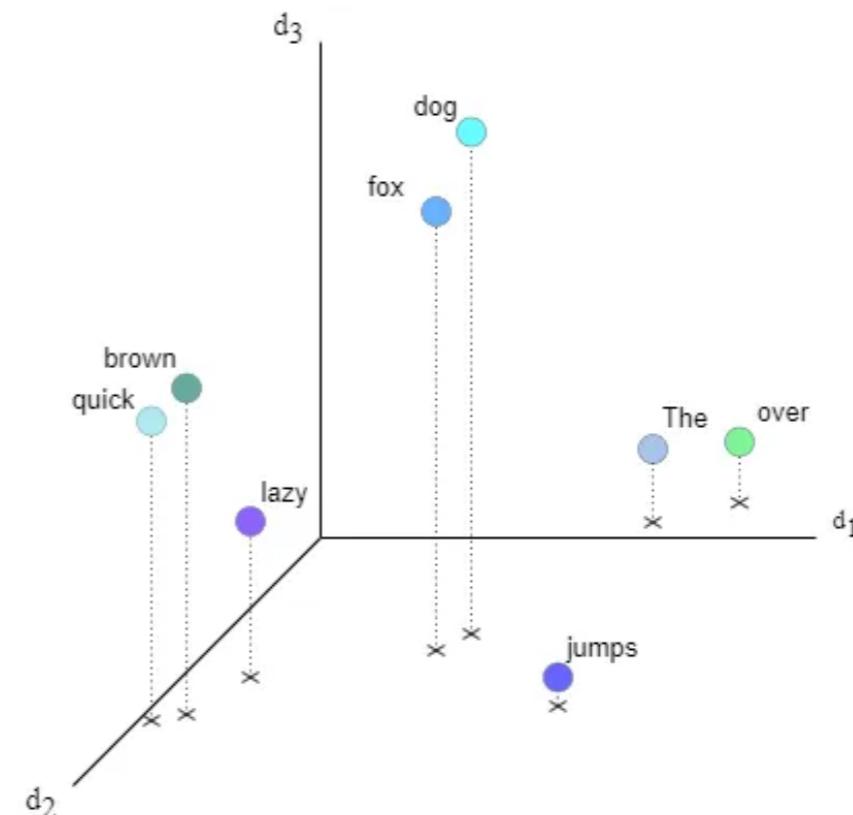


Embedding ?

Map items of unstructured data to high-dimensional real vectors

	0	1	2
The	0.64	-0.09	0.23
quick	0.05	0.79	0.47
brown	0.12	0.74	0.51
fox	0.42	0.52	0.83
jumps	0.88	0.69	0.02
over	0.84	-0.15	0.13
the	0.64	-0.09	0.23
lazy	0.1	0.65	0.28
dog	0.54	0.49	0.90

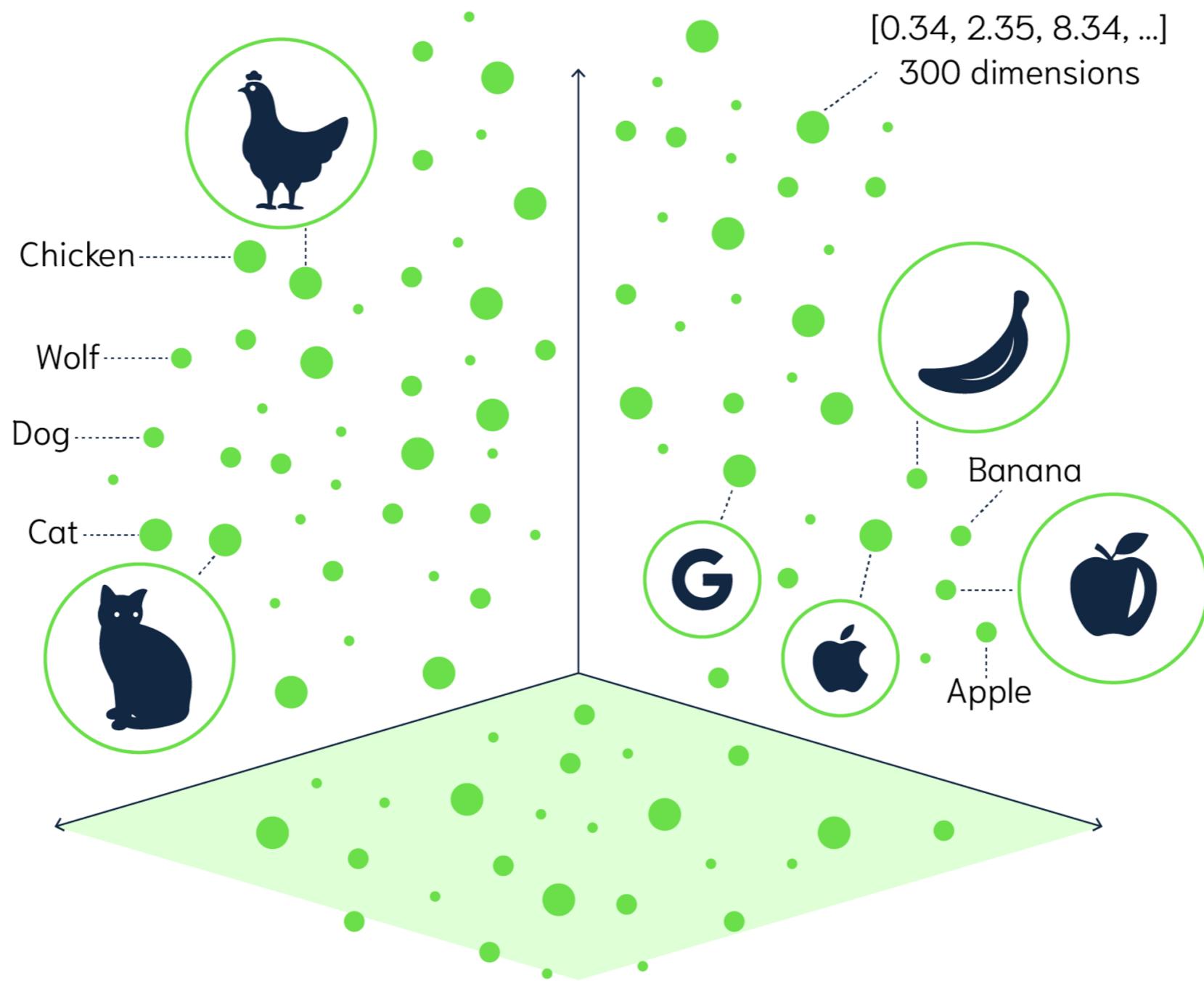
	d_{model}
.....	0.005
.....	-0.54
.....	-0.3
.....	0.01
.....	0.27
.....	0.05
.....	0.005
.....	-0.19
.....	0.008



<https://towardsdatascience.com/transfomers-in-depth-part-1-introduction-to-transformer-models-in-5-minutes-ad25da6d3cca>



Visual of Vector space



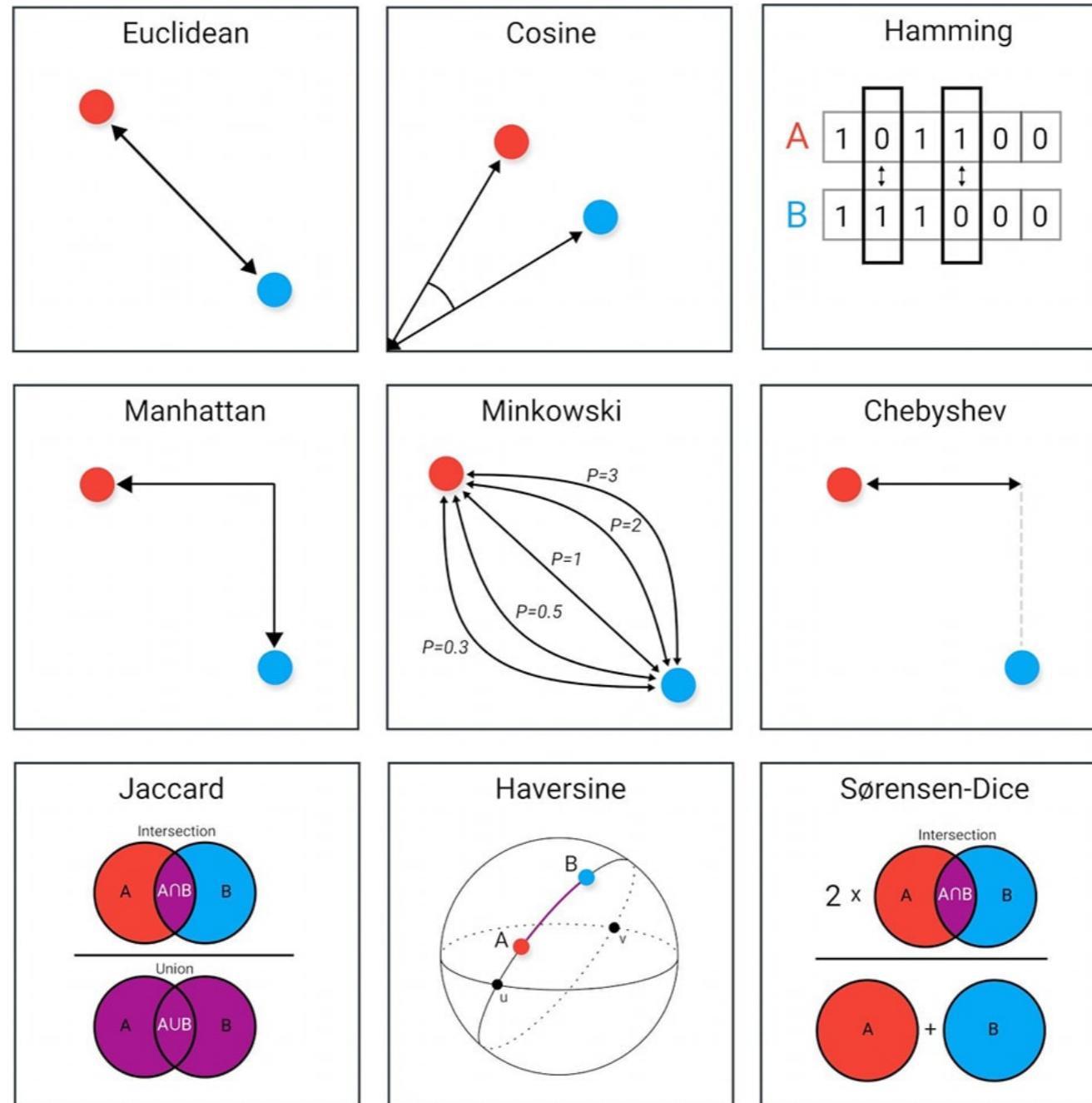
Embedding Leaderboard

Rank (Bor...	Model	Zero-shot	Memory U...	Number of P...	Embedding D...	Max Tokens	Mean (T...	Mean (TaskT...	Bitext ...	Classific
1	llama-embed-nemotron-8b	99%	28629	7B	4096	32768	69.46	61.09	81.72	73.21
2	Qwen3-Embedding-8B	99%	28866	7B	4096	32768	70.58	61.69	80.89	74.00
3	gemini-embedding-001	99%	Unknown	Unknown	3072	2048	68.37	59.59	79.28	71.82
4	Qwen3-Embedding-4B	99%	15341	4B	2560	32768	69.45	60.86	79.36	72.33
5	Qwen3-Embedding-0.6B	99%	2272	595M	1024	32768	64.34	56.01	72.23	66.83
6	gte-Qwen2-7B-instruct	⚠ NA	29040	7B	3584	32768	62.51	55.93	73.92	61.55
7	Linq-Embed-Mistral	99%	13563	7B	4096	32768	61.47	54.14	70.34	62.24
8	multilingual-e5-large-instruct	99%	1068	560M	1024	514	63.22	55.08	80.13	64.94
9	embeddinggemma-300m	99%	578	307M	768	2048	61.15	54.31	64.40	60.90
10	SFR-Embedding-Mistral	96%	13563	7B	4096	32768	60.90	53.92	70.00	60.02
11	text-multilingual-embedding-002	99%	Unknown	Unknown	768	2048	62.16	54.25	70.73	64.64

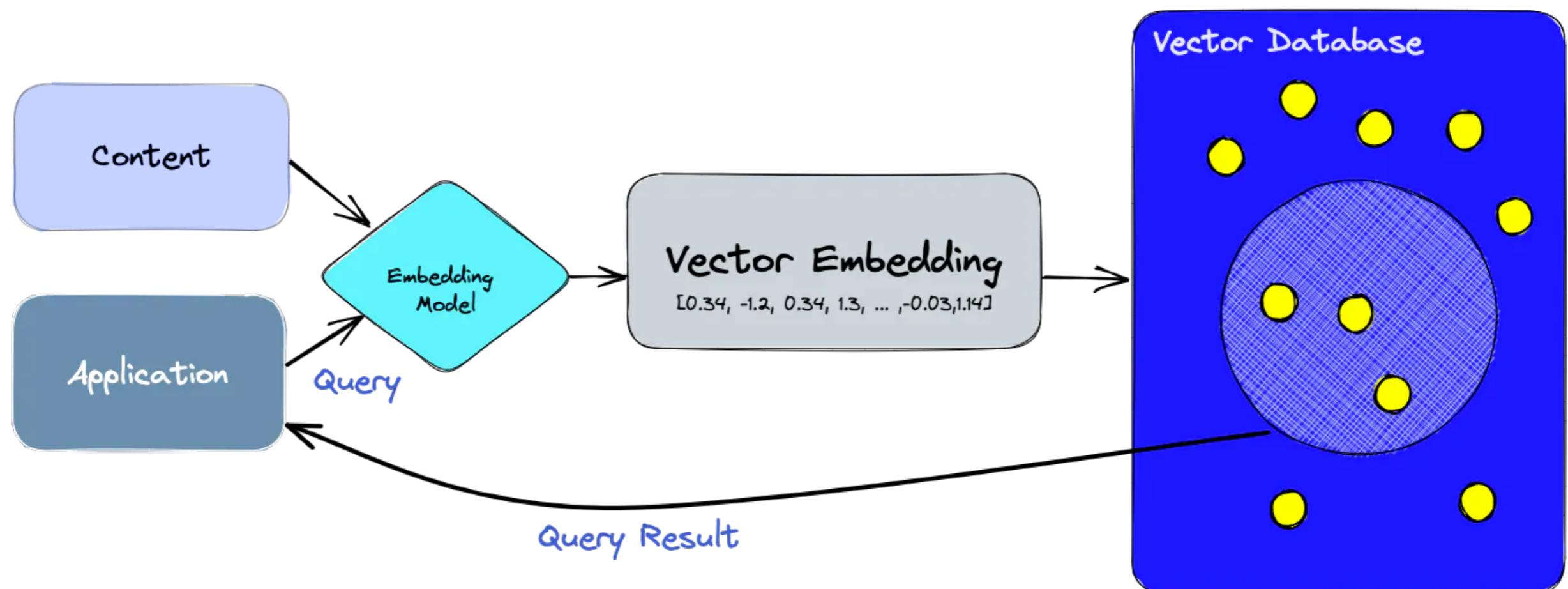
<https://huggingface.co/spaces/mteb/leaderboard>



Distance measure in Data Science

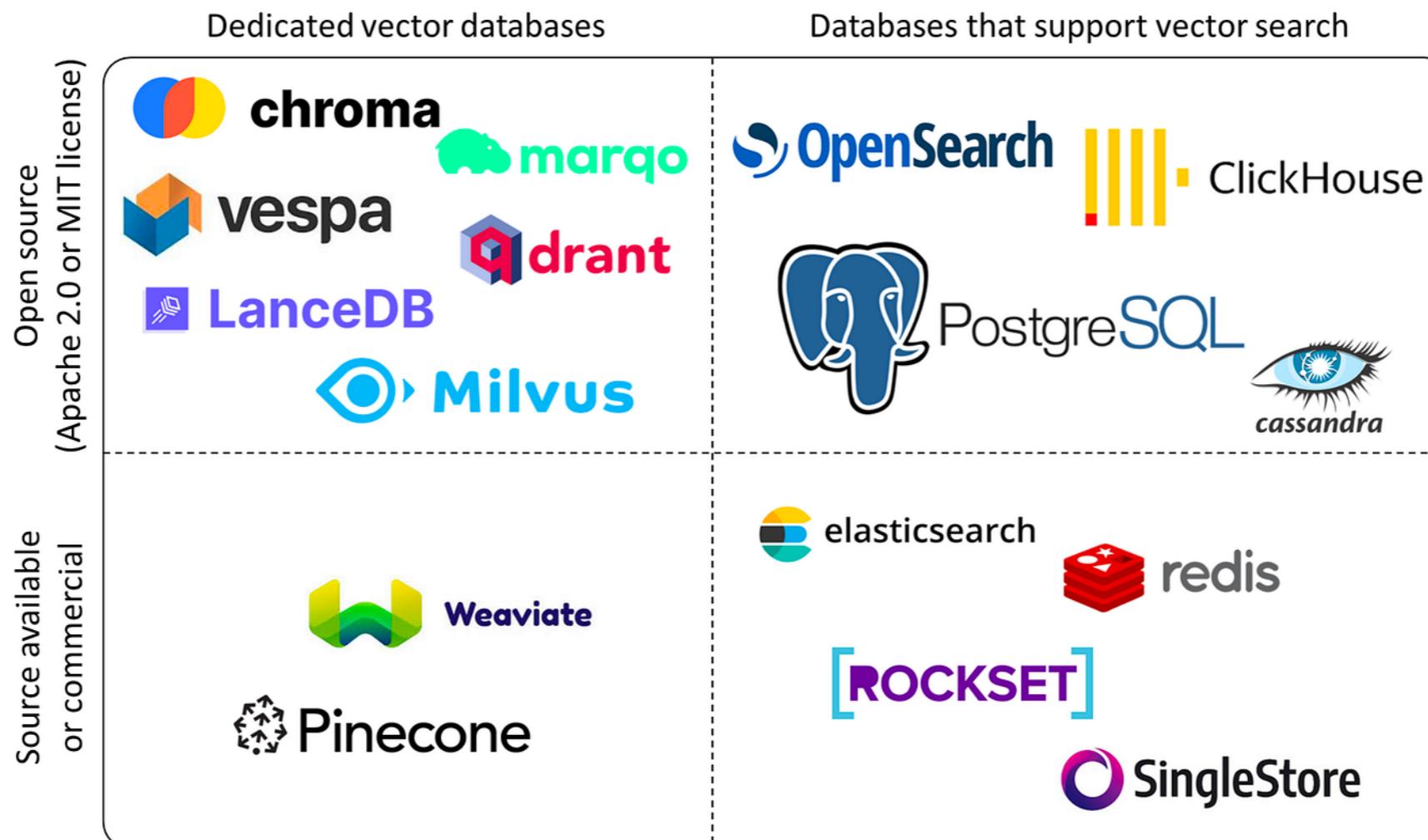


Store data in Vector Database



Vector Database ?

Map items of unstructured data to high-dimensional real vectors



<https://towardsdatascience.com/transformers-in-depth-part-1-introduction-to-transformer-models-in-5-minutes-ad25da6d3cca>



Application

Infrastructure

Model



Application

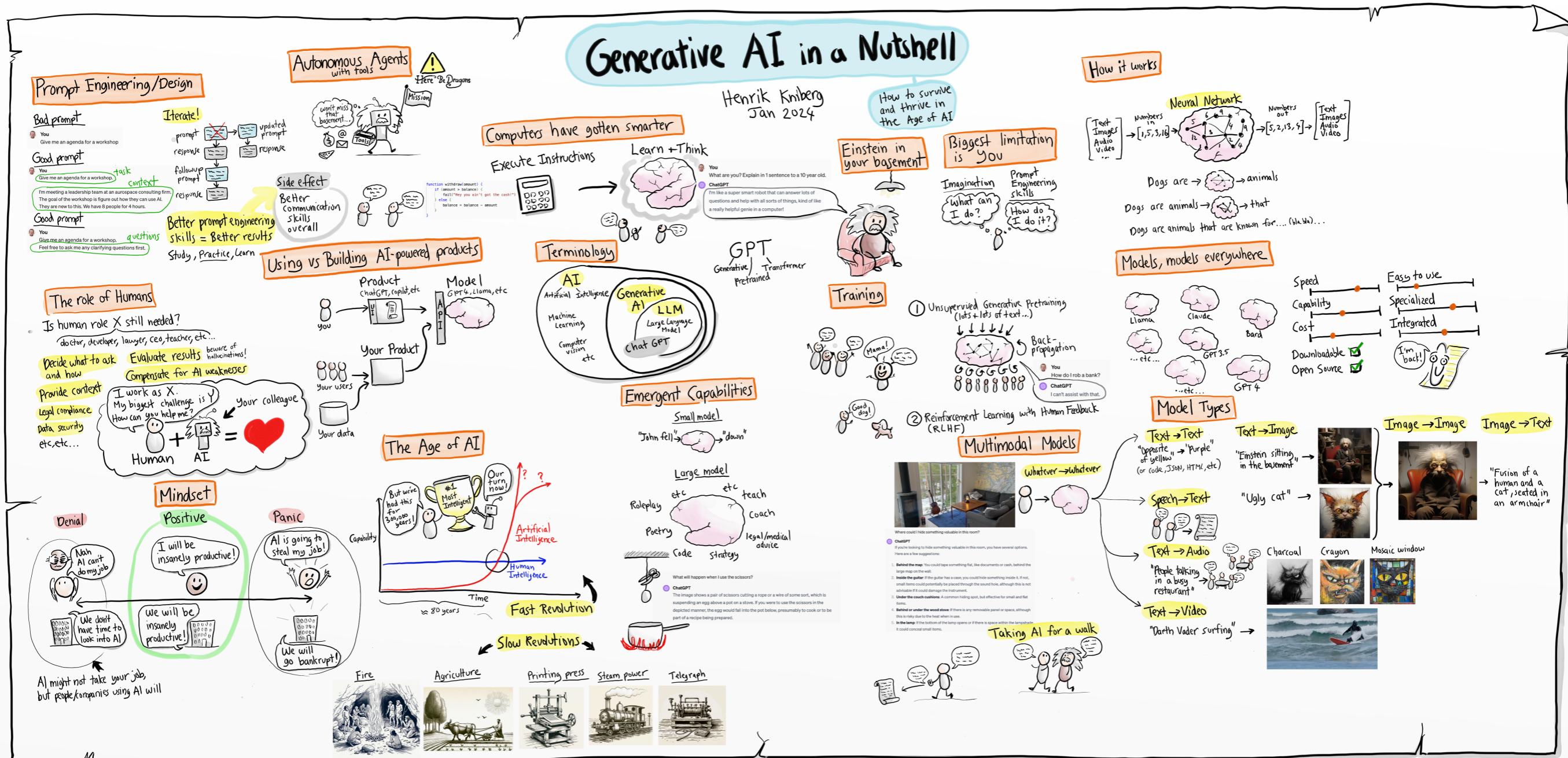
REST API

Infrastructure

Model



Generative AI in Nutshell

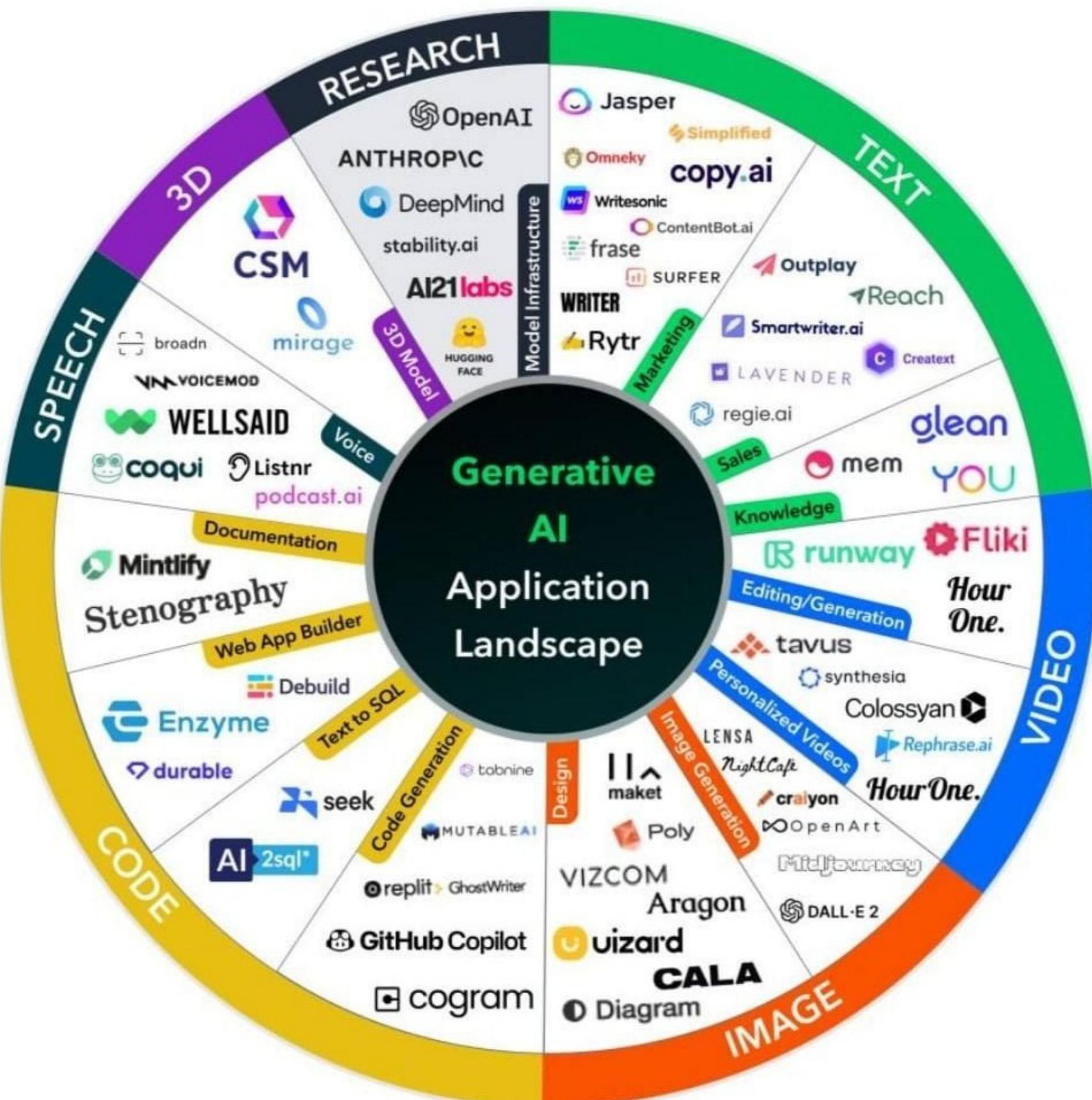


<https://www.youtube.com/watch?v=2IK3DFHRFfw>



Application Tool chains





Tool chains category

Assist
tasks

Interaction
modes

Prompt
composition

Properties of
model



Assist tasks

Finding information faster in context

Generating code

Reasoning about code

Transforming code into something ..

Requirement

Design

Develop

Testing

Deploy

Software Delivery Lifecycle



Interaction modes

Chat interfaces

In-line assistance (typing in code editor)
CLI (command-line interface)



Z.ai

The screenshot shows the Z.ai AI interface. At the top left, there are icons for a clock, a document, and 'GLM-4.5' with a dropdown arrow. On the right, there are 'API ↗' and 'Sign in' buttons. The main heading 'Hi, I'm Z.ai' is centered above a large input field containing the placeholder 'How can I help you today?'. Below the input field are several buttons: a '+' button, a 'Tools' button with three horizontal lines, a 'Deep Think' button with a brain icon, and a font size adjustment button with an 'A' and a minus sign. At the bottom, there are five service buttons: 'AI Slides 🔥', 'Full-Stack', 'Magic Design', 'Deep Research', and 'Write code'.

<https://z.ai/>



Models

Models

Language Models Image Models Video Generation Models

GLM-4.6
Z.ai's latest model achieves SOTA among open-source models! Context window expanded to 200K. Brings you superior performance in real-world coding, reasoning, tool using and role-playing.

Learn More >

GLM-4.5-Air
Z.ai's new lightweight flagship model delivers SOTA performance with exceptional cost-effectiveness!

Learn More >

GLM-4.5-Flash
The free version of GLM-4.5 now stands as Z.ai's most powerful offering, delivering unparalleled performance at no cost.

Learn More >

GLM-4.5V
Achieve the state-of-the-art (SOTA) performance among open-source VLMs of the same level in various benchmark tests.

Learn More >

GLM-4-32B-0414-128K
A general-purpose, cost-efficient LLM for advanced Q&A, coding, search, and structured task automation across business and technical domains.

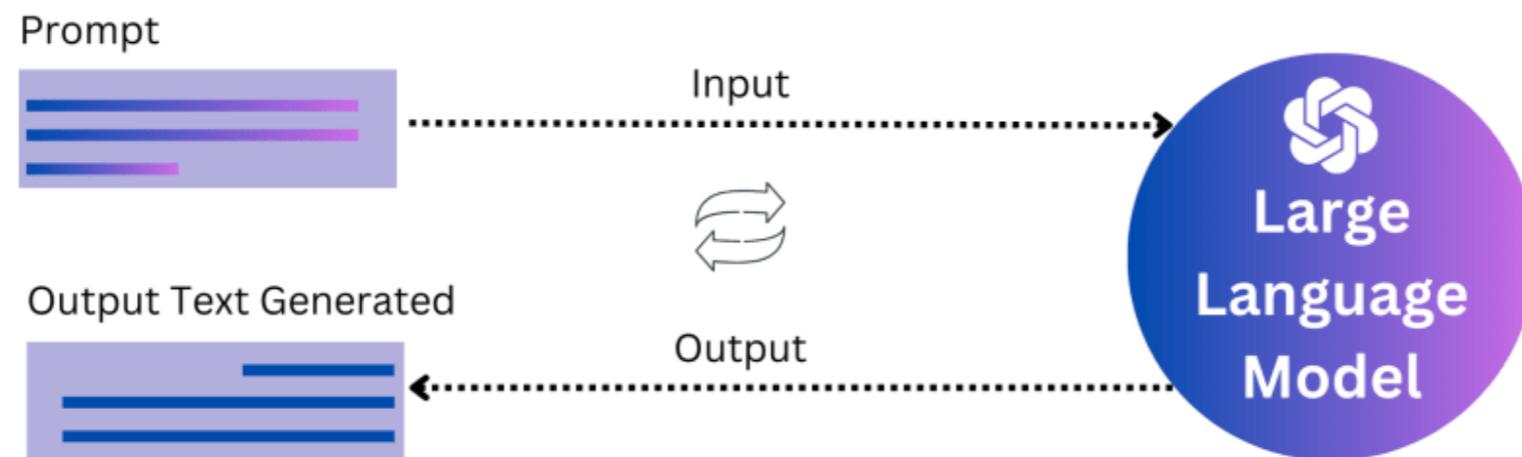
Learn More >

<https://z.ai/>



Prompt composition

Prompt engineering
Compose prompts from user inputs and context



<https://platform.openai.com/docs/guides/prompt-engineering>



Better Prompt

Write clear instructions

Provide reference text

Split complex tasks into simpler subtasks

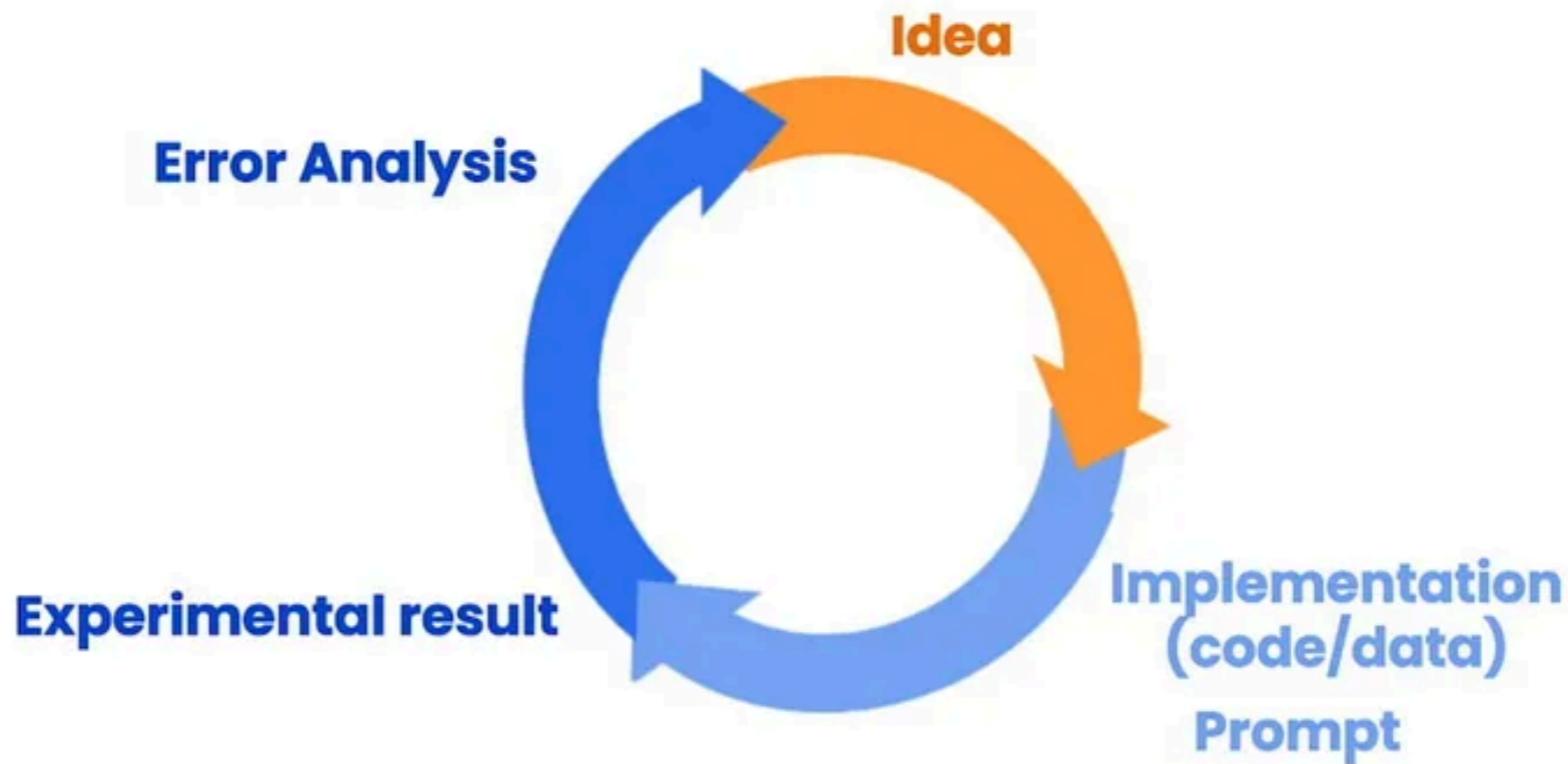
Give the model time to think

Testing and improve ...

<https://platform.openai.com/docs/guides/prompt-engineering>



Iterative Prompt Development



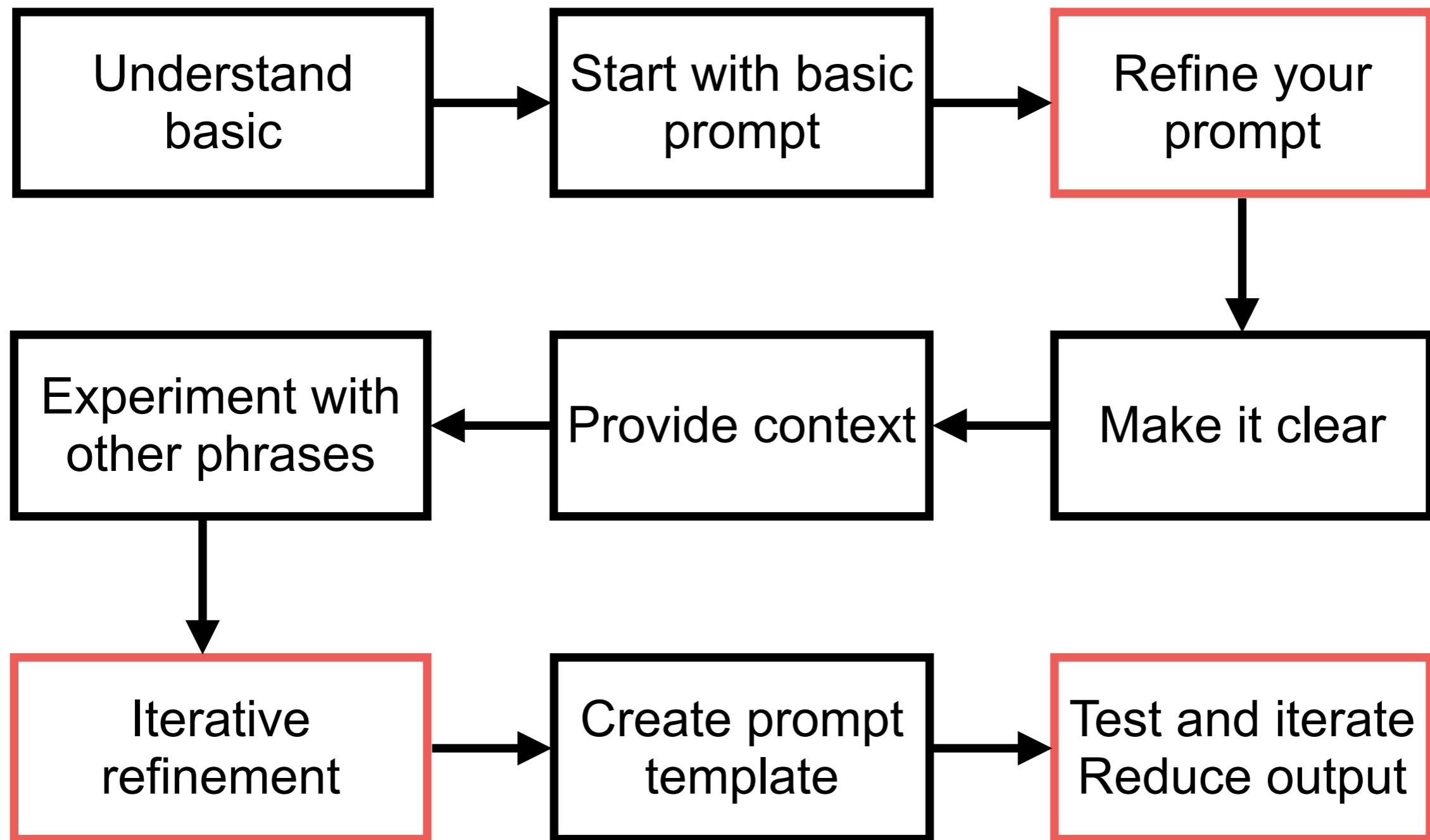
Iterative Process

- Try something
- Analyze where the result does not give what you want
- Clarify instructions, give more time to think
- Refine prompts with a batch of examples

<https://www.deeplearning.ai/short-courses/chatgpt-prompt-engineering-for-developers/>



Basic of Prompt Engineer



Better Prompt

Write clear instructions

Provide reference text

Split complex tasks into simpler subtasks

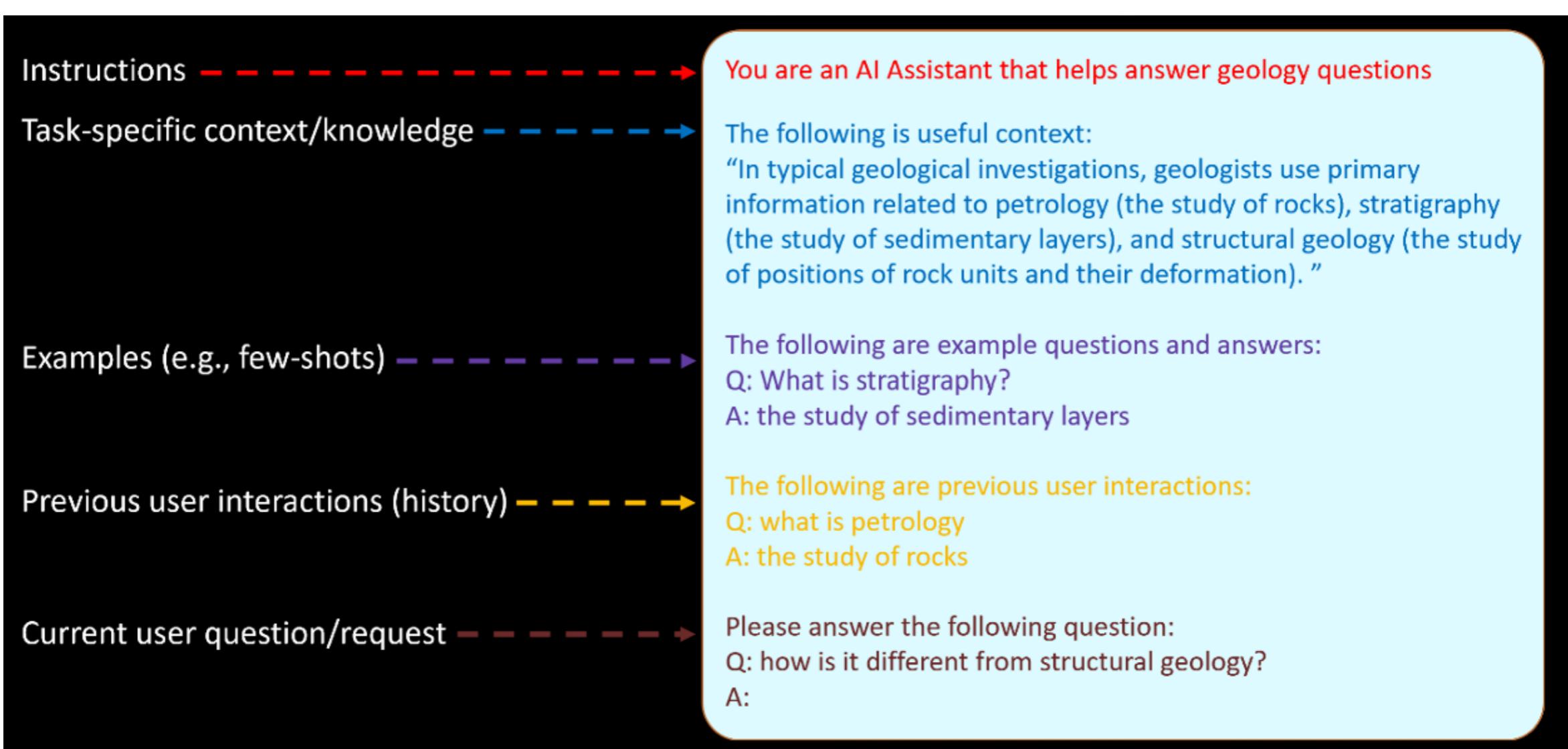
Give the model time to think

Testing and improve ...

<https://platform.openai.com/docs/guides/prompt-engineering/six-strategies-for-getting-better-results>



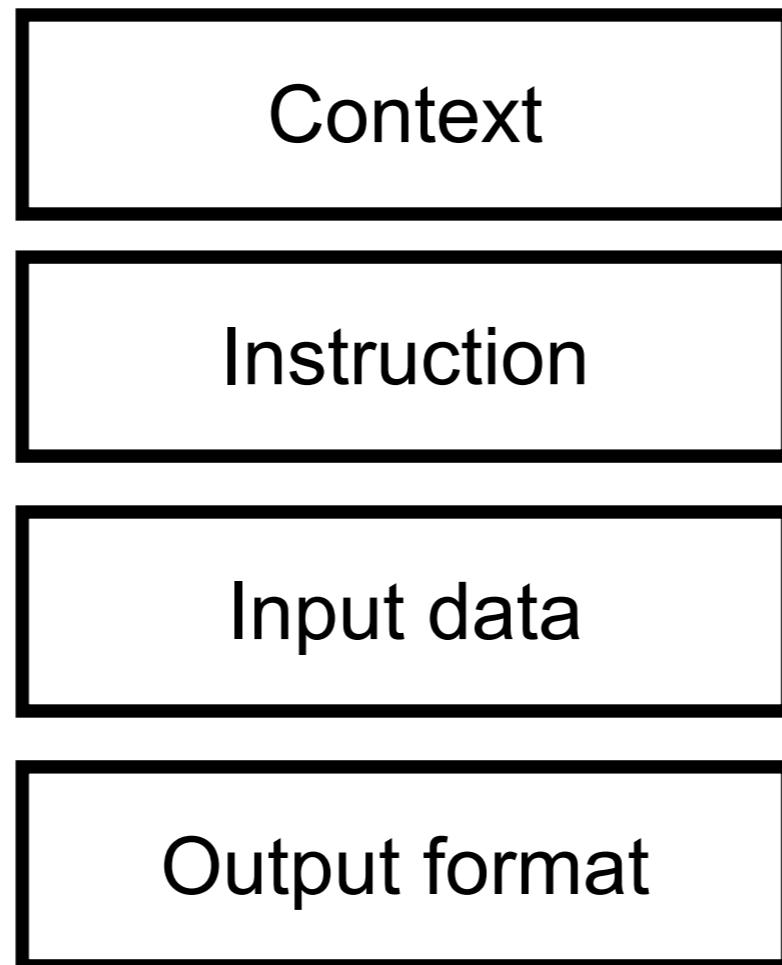
Prompt Structure



<https://learn.microsoft.com/en-us/ai/playbook/technology-guidance/generative-ai/working-with-langs/prompt-engineering>



Structure of Prompt



<https://platform.openai.com/docs/guides/prompt-engineering>



Prompting Guide

Prompt Engineering

Prompt Engineering Guide

Prompt engineering is a relatively new discipline for developing and optimizing prompts to efficiently use language models (LMs) for a wide variety of applications and research topics. Prompt engineering skills help to better understand the capabilities and limitations of large language models (LLMs).

Researchers use prompt engineering to improve the capacity of LLMs on a wide range of common and complex tasks such as question answering and arithmetic reasoning. Developers use prompt engineering to design robust and effective prompting techniques that interface with LLMs and other tools.

Prompt engineering is not just about designing and developing prompts. It encompasses a wide range of skills and techniques that are useful for interacting and developing with LLMs. It's an important skill to interface, build with, and understand capabilities of LLMs. You can use prompt engineering to improve safety of LLMs and build new capabilities like augmenting LLMs with domain knowledge and external tools.

<https://www.promptingguide.ai/>



Structure of Prompt !!

APE
Action, Purpose,
Expectation

RACE
Role, Action,
Context,
Expectation

TAG
Task, Action, Goal

COAST
Context, Objective,
Action, Scenario,
Task

RISE
Role, Input, Step,
Expectation

<https://twitter.com/pradeepeth/status/1673271866696544257>



Prompt Techniques

Zero-shot

Chain-of
Thought (CoT)

Few-shot

Meta or structure

<https://www.promptingguide.ai/techniques>



Chain of Thought Prompting (CoT)

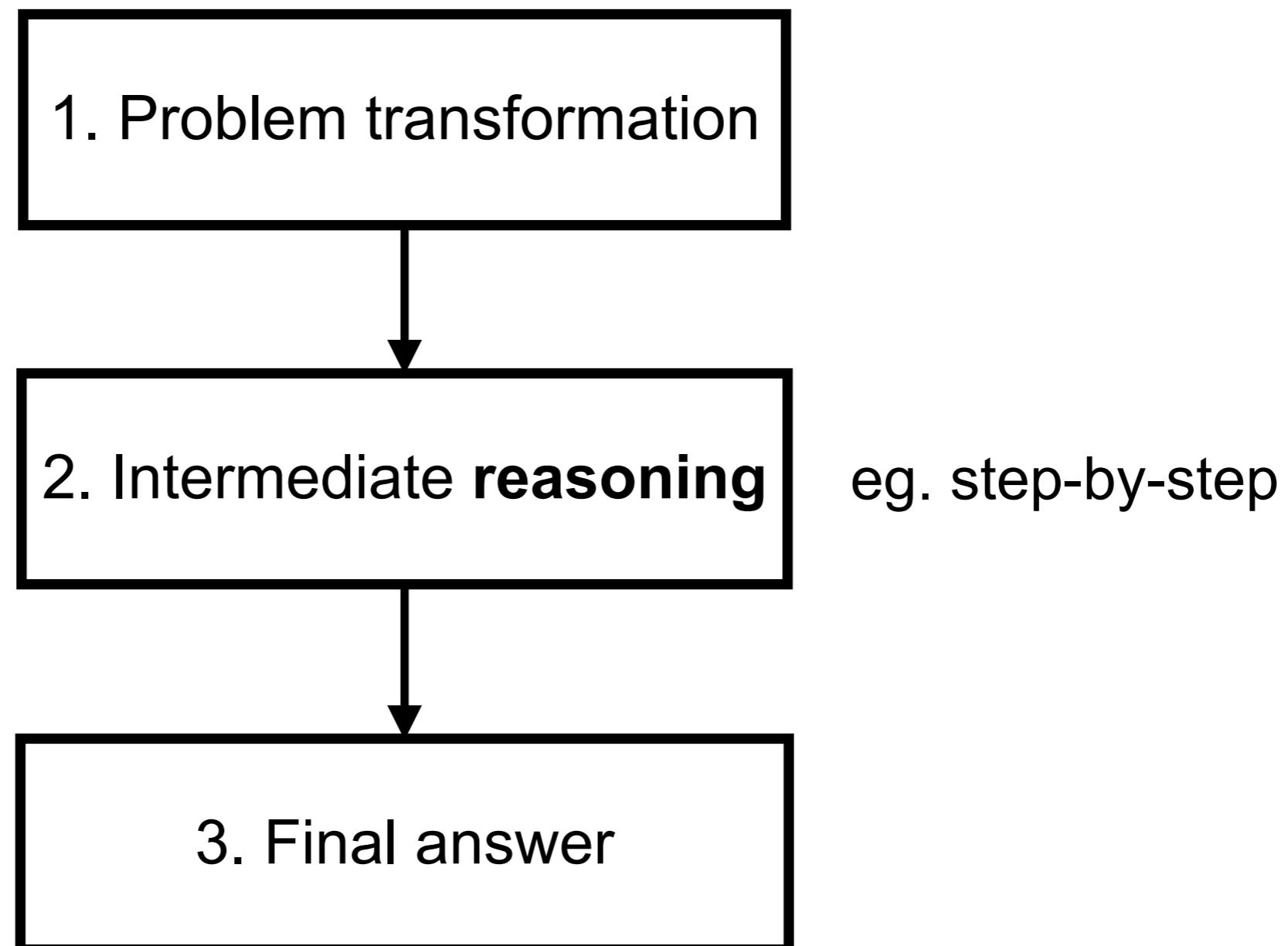
Technique used to improve the reasoning ability of LLM

Try to break down a complex problem into smaller, More manageable steps, lead to final answer

Reasoning model !!



Chain of Thought Prompting (CoT)



Chain of Thought Prompting (CoT)

(a) Few-shot

Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?

A: The answer is 11.

Q: A juggler can juggle 16 balls. Half of the balls are golf balls, and half of the golf balls are blue. How many blue golf balls are there?

A:

(Output) The answer is 8. ✗

(b) Few-shot-CoT

Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?

A: Roger started with 5 balls. 2 cans of 3 tennis balls each is 6 tennis balls. $5 + 6 = 11$. The answer is 11.

Q: A juggler can juggle 16 balls. Half of the balls are golf balls, and half of the golf balls are blue. How many blue golf balls are there?

A:

(Output) The juggler can juggle 16 balls. Half of the balls are golf balls. So there are $16 / 2 = 8$ golf balls. Half of the golf balls are blue. So there are $8 / 2 = 4$ blue golf balls. The answer is 4. ✓

(c) Zero-shot

Q: A juggler can juggle 16 balls. Half of the balls are golf balls, and half of the golf balls are blue. How many blue golf balls are there?

A: The answer (arabic numerals) is

(Output) 8 ✗

(d) Zero-shot-CoT (Ours)

Q: A juggler can juggle 16 balls. Half of the balls are golf balls, and half of the golf balls are blue. How many blue golf balls are there?

A: Let's think step by step.

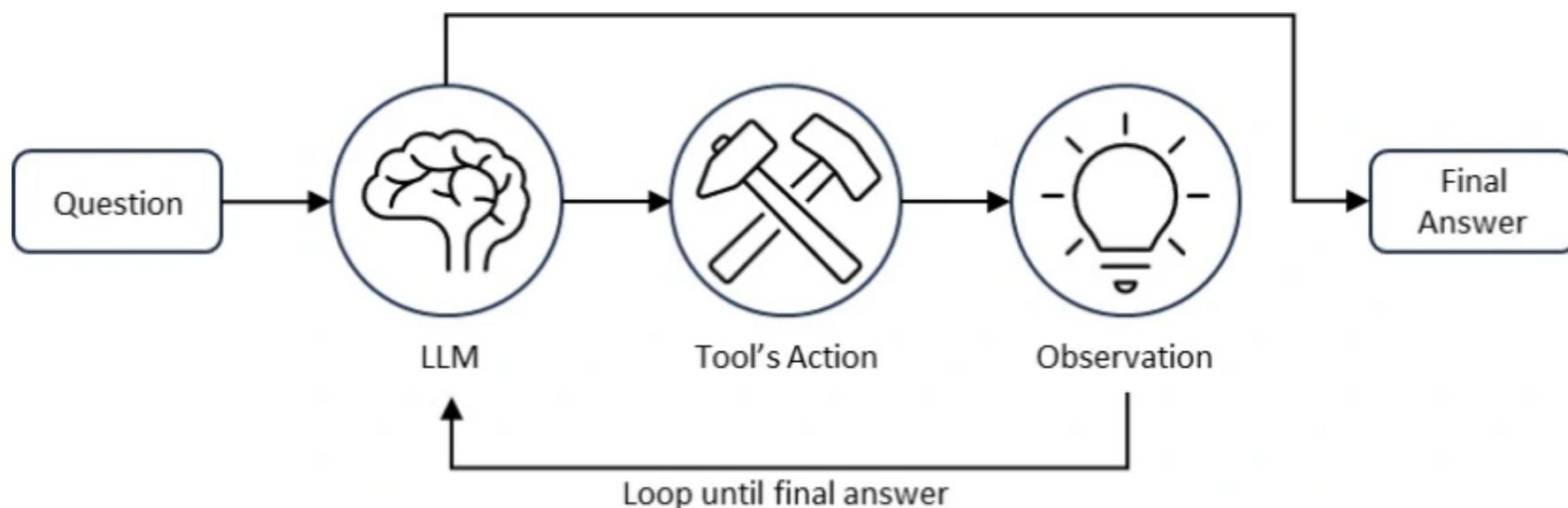
(Output) There are 16 balls in total. Half of the balls are golf balls. That means that there are 8 golf balls. Half of the golf balls are blue. That means that there are 4 blue golf balls. ✓

<https://www.promptingguide.ai/techniques/cot>



ReAct Prompt

LLM reasoning and additional tools (expert)
Improve better answer



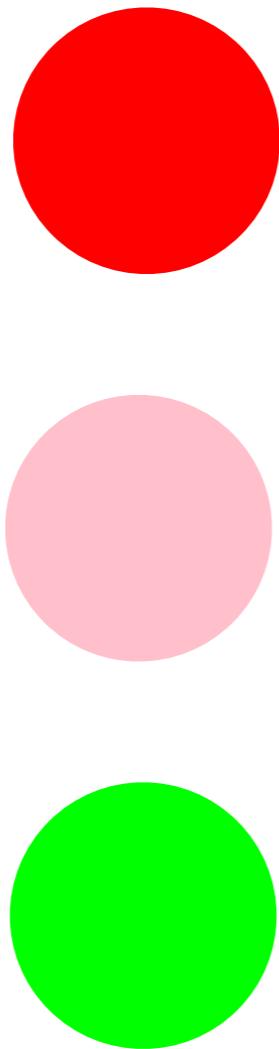
<https://www.promptingguide.ai/techniques/react>



Workshop



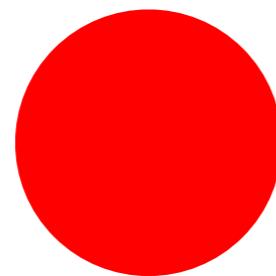
RGB ?



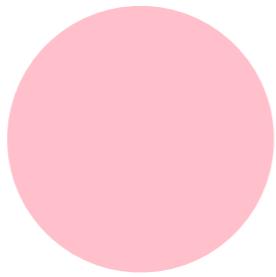
<https://github.com/up1/workshop-ai-with-technical-team/tree/main/workshop/demo-rgb>



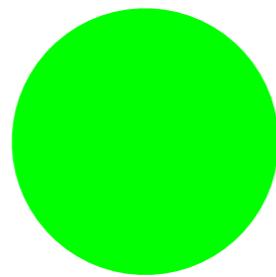
RGB ?



[255, 0, 0]



[255, 192, 203]

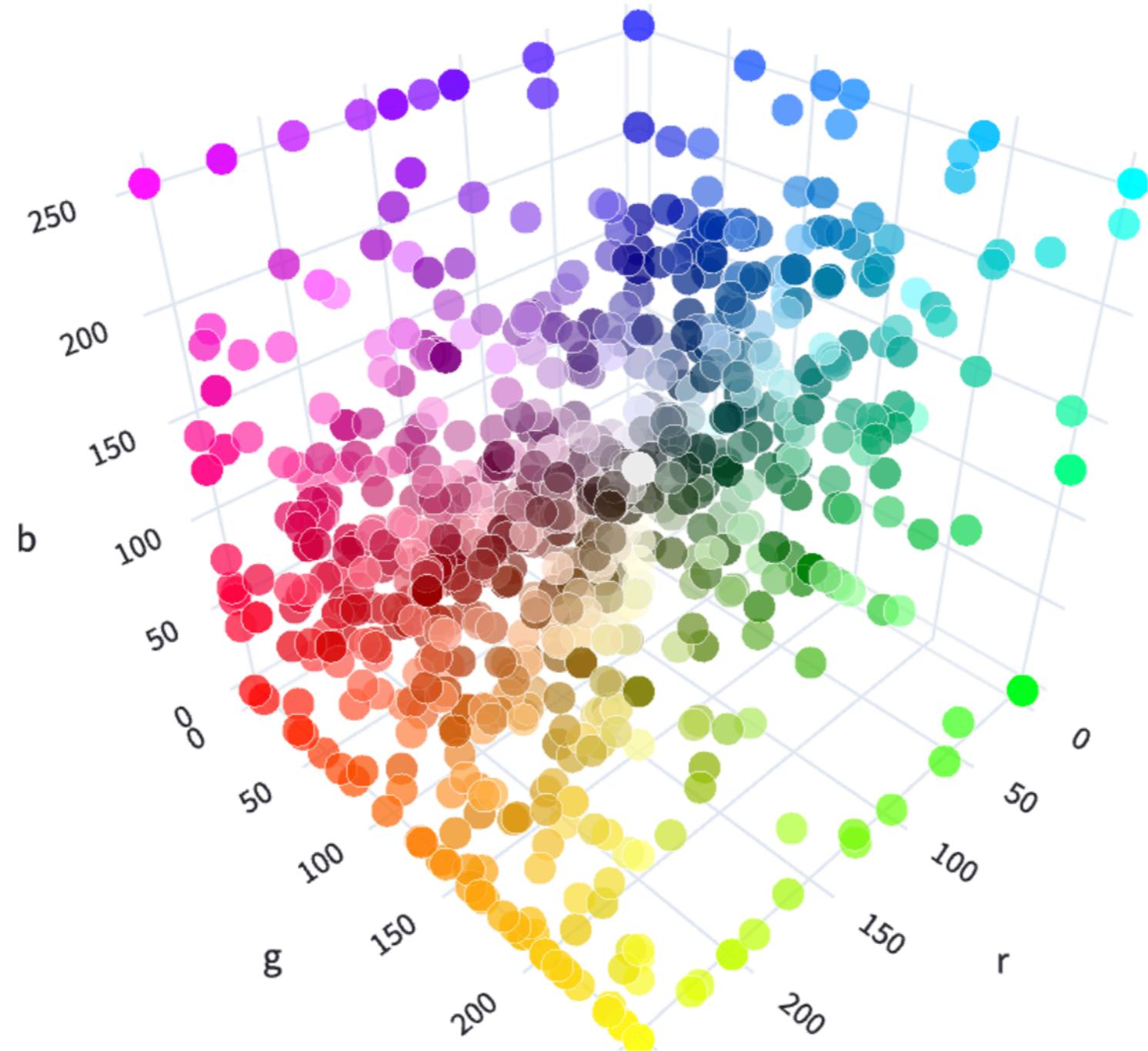


[0, 255, 0]

<https://github.com/up1/workshop-ai-with-technical-team/tree/main/workshop/demo-rgb>



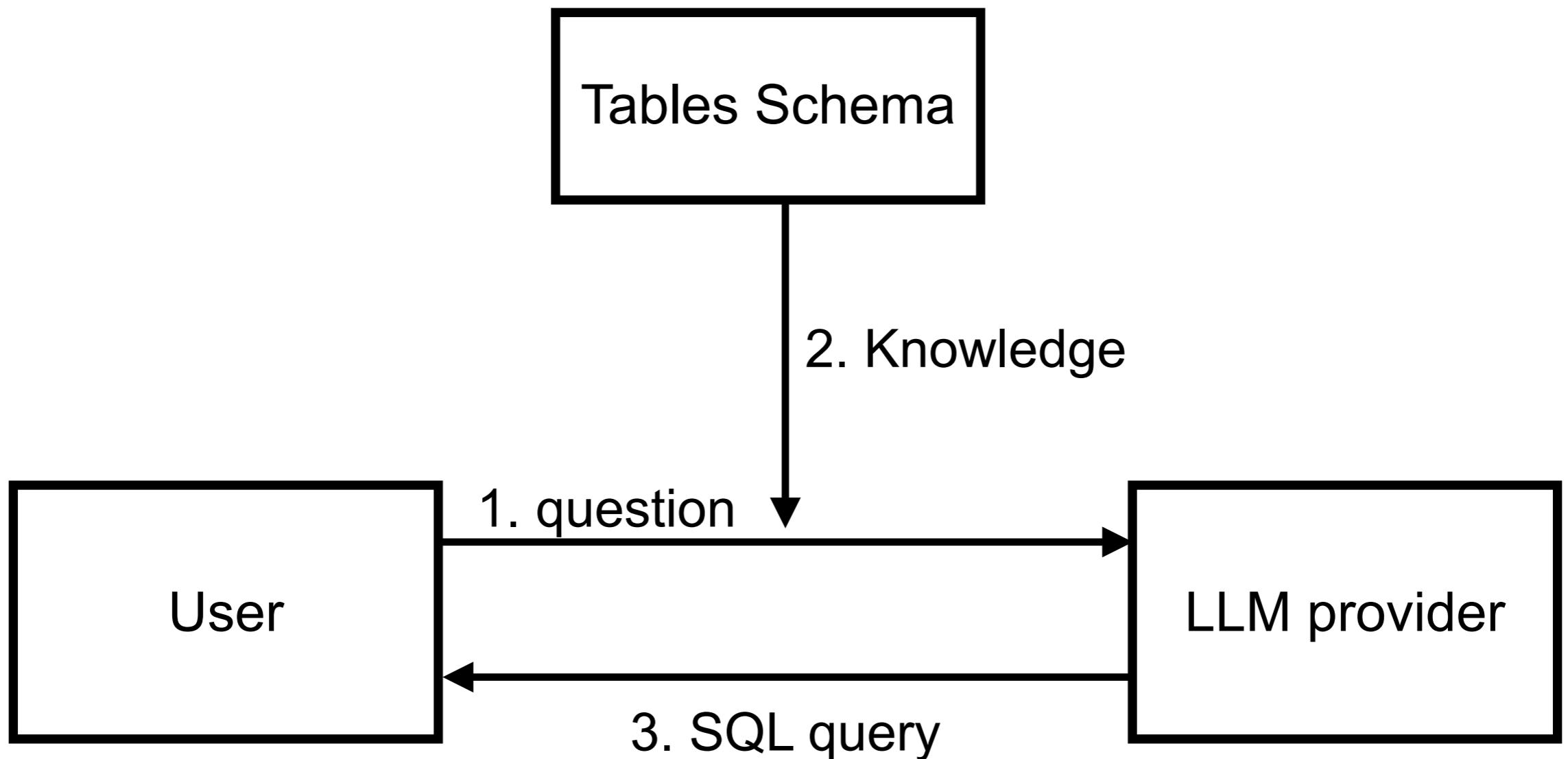
Visualize RGB



https://huggingface.co/spaces/jphwang/colorful_vectors



Text-to-SQL



<https://github.com/up1/workshop-ai-with-technical-team/tree/main/workshop/demo-sql>



Software Development Life Cycle



SDLC

Requirement

Design

Develop

Testing

Deploy



Planning

Written planning process

Arch diagrams

Testing

Automated testing

TDD

Testing environments

Testing in prod

Performance testing

Load testing

Generate test data

Development

Automated dev env

CI/CD

Prototyping

Code review

Code generation

Templates

Cross-platform dev

Preview env

Post-commit code review

Linting

Static code analysis

Project mgmt

Shipping

FF & experimentation

Logging

Monitoring & alerting

Staged rollouts

Maintenance

Debug production

Documentation

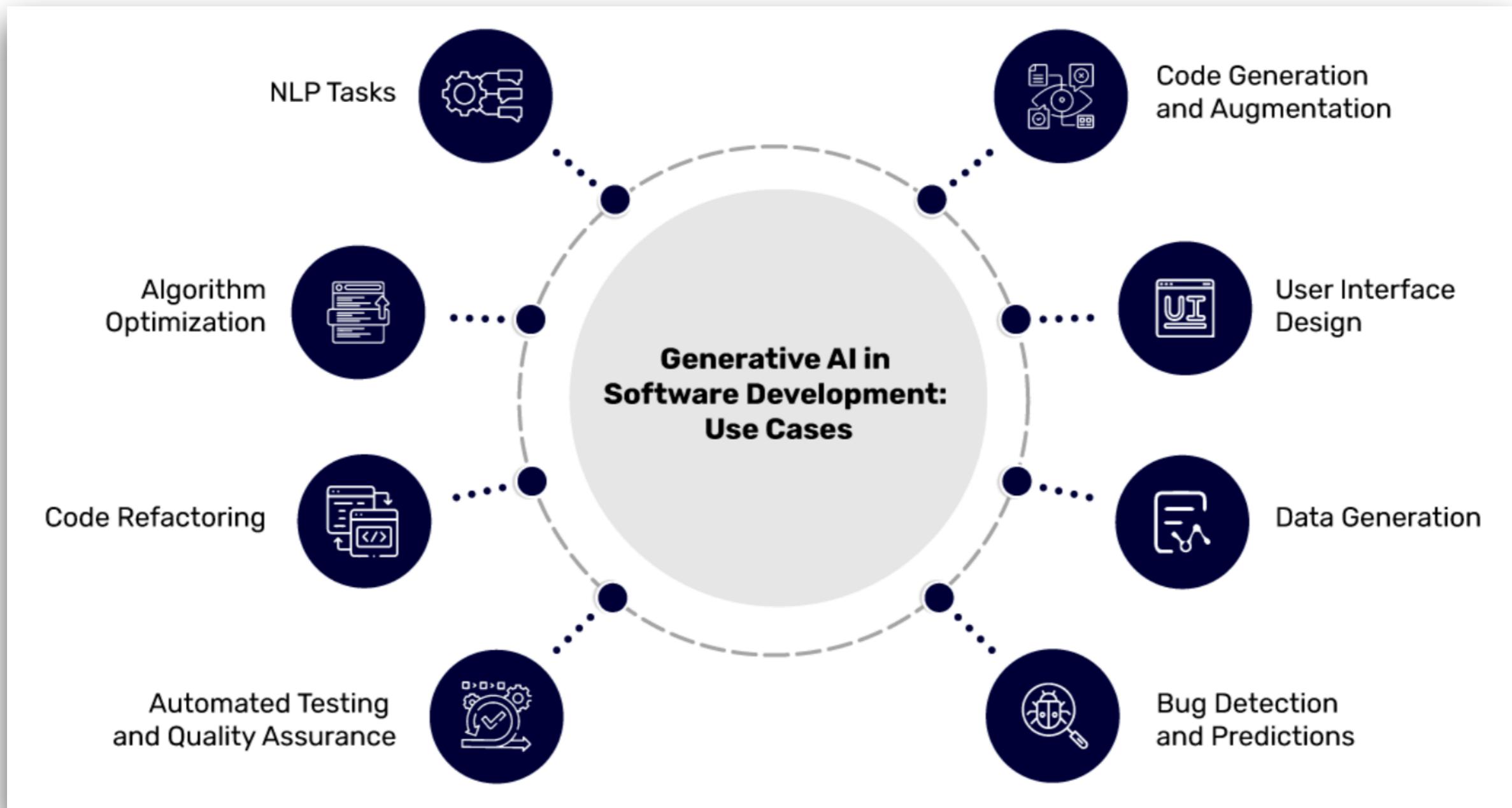
Runbook examples

Mitigation runbook

pragmaticengineer.com



SDLC



Impacts with productivity ?

Automated
simple tasks

Improve quality
and reliability

Improve
communication

Faster
prototype



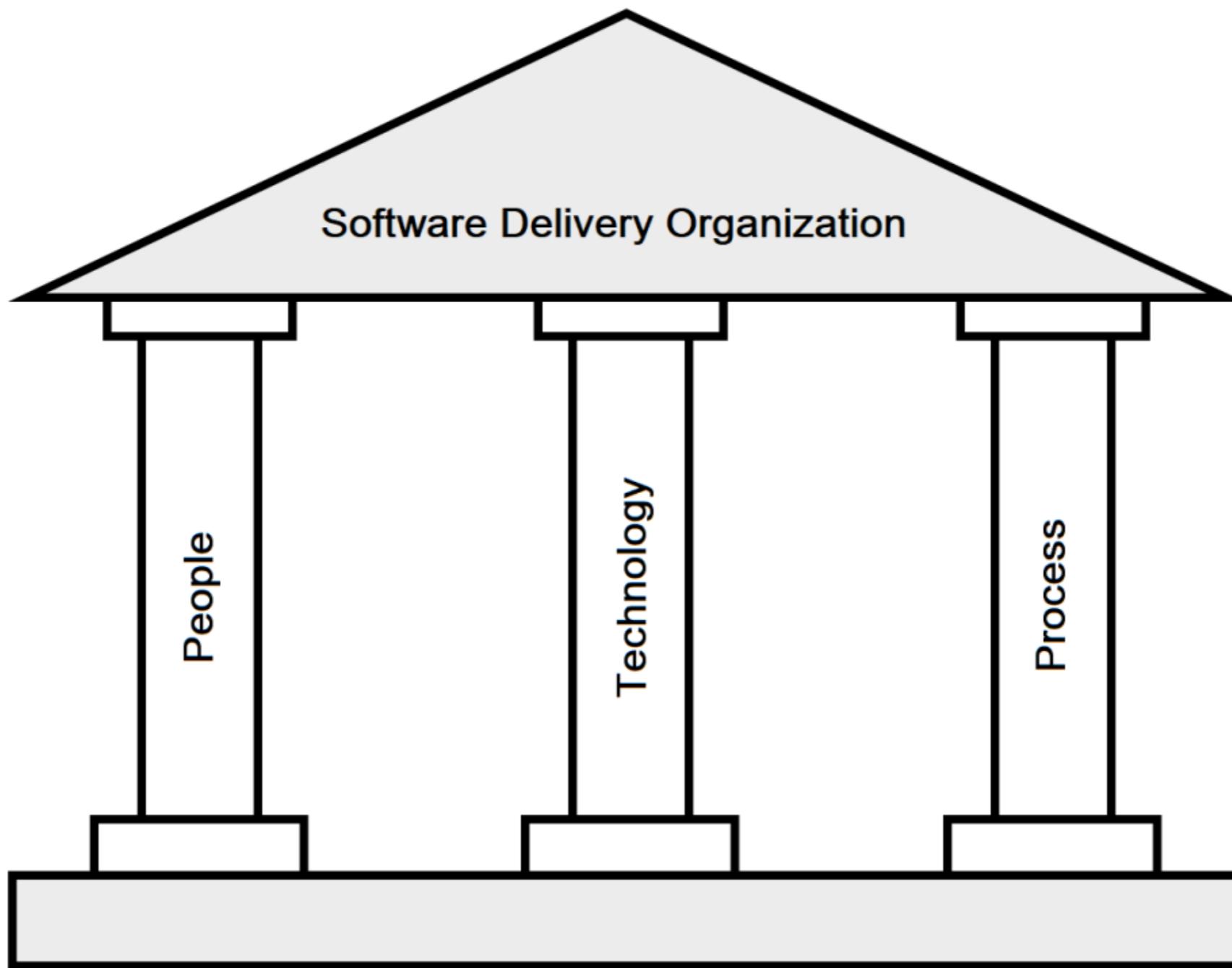
**Generative AI isn't just a tool
it's your team member**



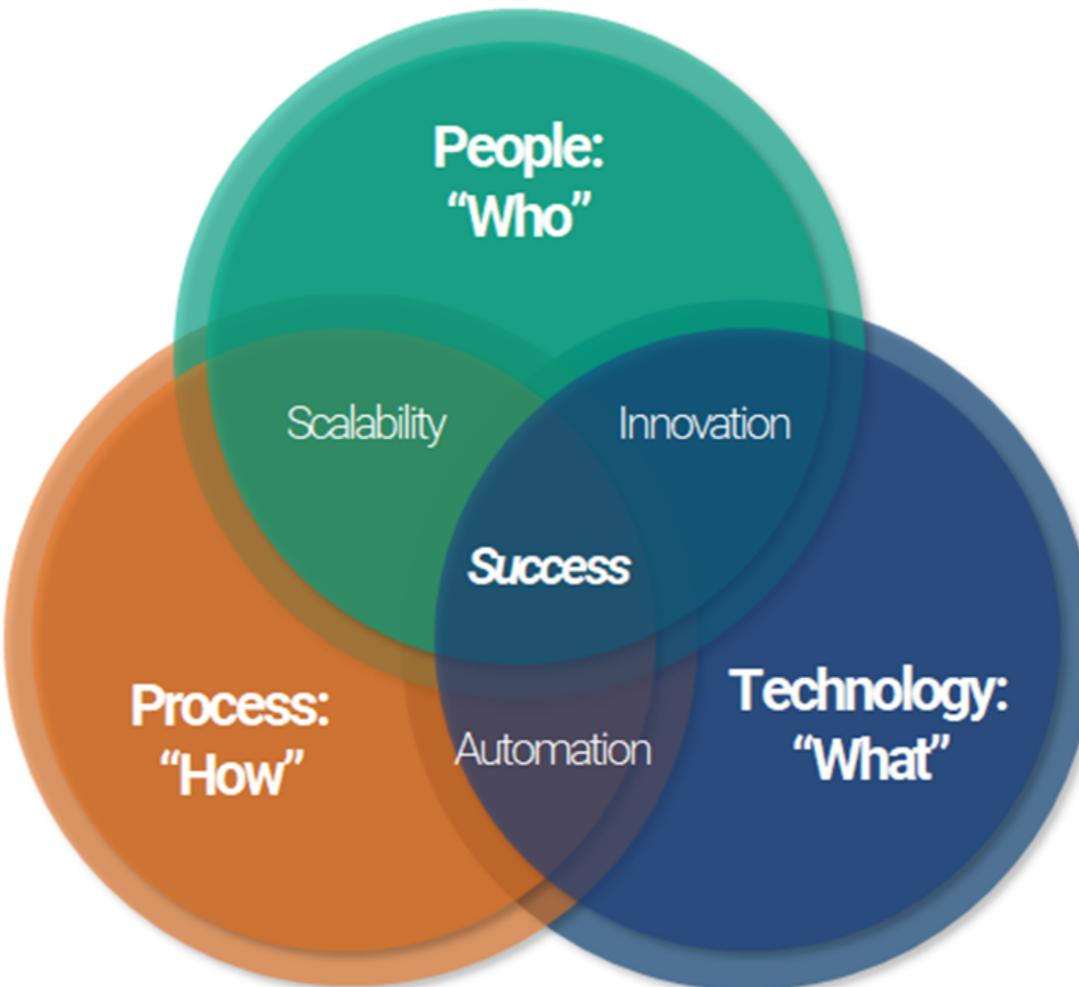
Trust, but verify output !!



3 Pillar of Software Development



3 Pillar of Software Development



Requirement and Analysis



Requirement and Analysis

Requirement

Design

Develop

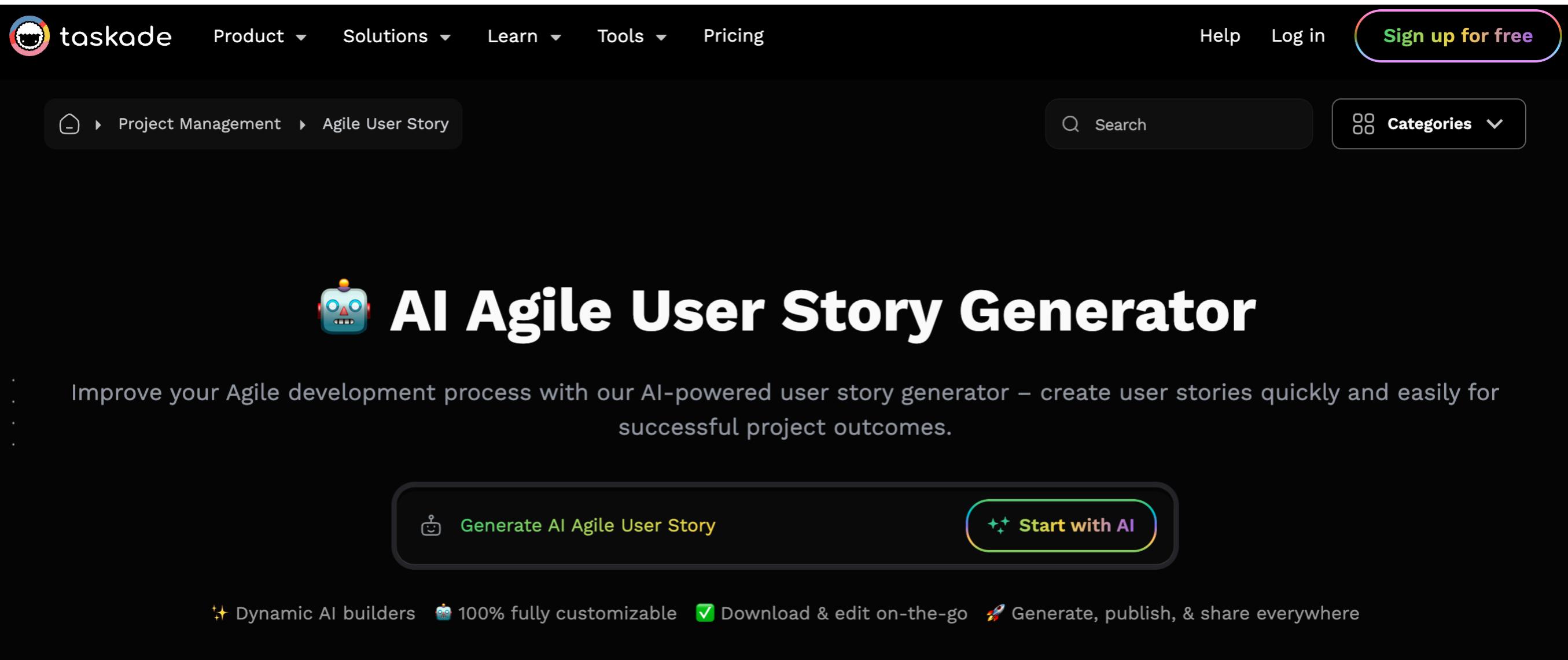
Testing

Deploy

Requirements writing and analysis
User story generation



Agents AI for Automated tasks



The screenshot shows the Taskade AI Agile User Story Generator landing page. At the top, there's a navigation bar with links for Product, Solutions, Learn, Tools, Pricing, Help, Log in, and a prominent "Sign up for free" button. Below the navigation is a breadcrumb menu showing "Project Management > Agile User Story". To the right are search and categories filters. The main title "AI Agile User Story Generator" is displayed with a small robot icon. A sub-copy below it reads: "Improve your Agile development process with our AI-powered user story generator – create user stories quickly and easily for successful project outcomes." Two buttons are present: "Generate AI Agile User Story" and "Start with AI". At the bottom, four features are listed with icons: "Dynamic AI builders", "100% fully customizable", "Download & edit on-the-go", and "Generate, publish, & share everywhere".

taskade

Product ▾ Solutions ▾ Learn ▾ Tools ▾ Pricing

Help Log in Sign up for free

Project Management ▶ Agile User Story

Search Categories

AI Agile User Story Generator

Improve your Agile development process with our AI-powered user story generator – create user stories quickly and easily for successful project outcomes.

Generate AI Agile User Story Start with AI

Dynamic AI builders 100% fully customizable Download & edit on-the-go Generate, publish, & share everywhere

<https://www.taskade.com/generate/project-management/agile-user-story>



Example with food delivery

Food Delivery Workflow Template

 **Order Processing #order**

- Check for new orders
 - Verify customer details
 - Confirm payment status
- Prepare order items
 - Gather ingredients
 - Cook or prepare food
 - Package items securely

 **Delivery Management #delivery**

- Assign delivery driver
- Plan delivery route
 - Prioritize multiple deliveries
 - Use GPS for directions
- Confirm delivery with customer
 - Send delivery notification
 - Obtain customer signature

 **Post-Delivery Tasks #postdelivery**

 What would you like to do next? ➤

 Create project ➡

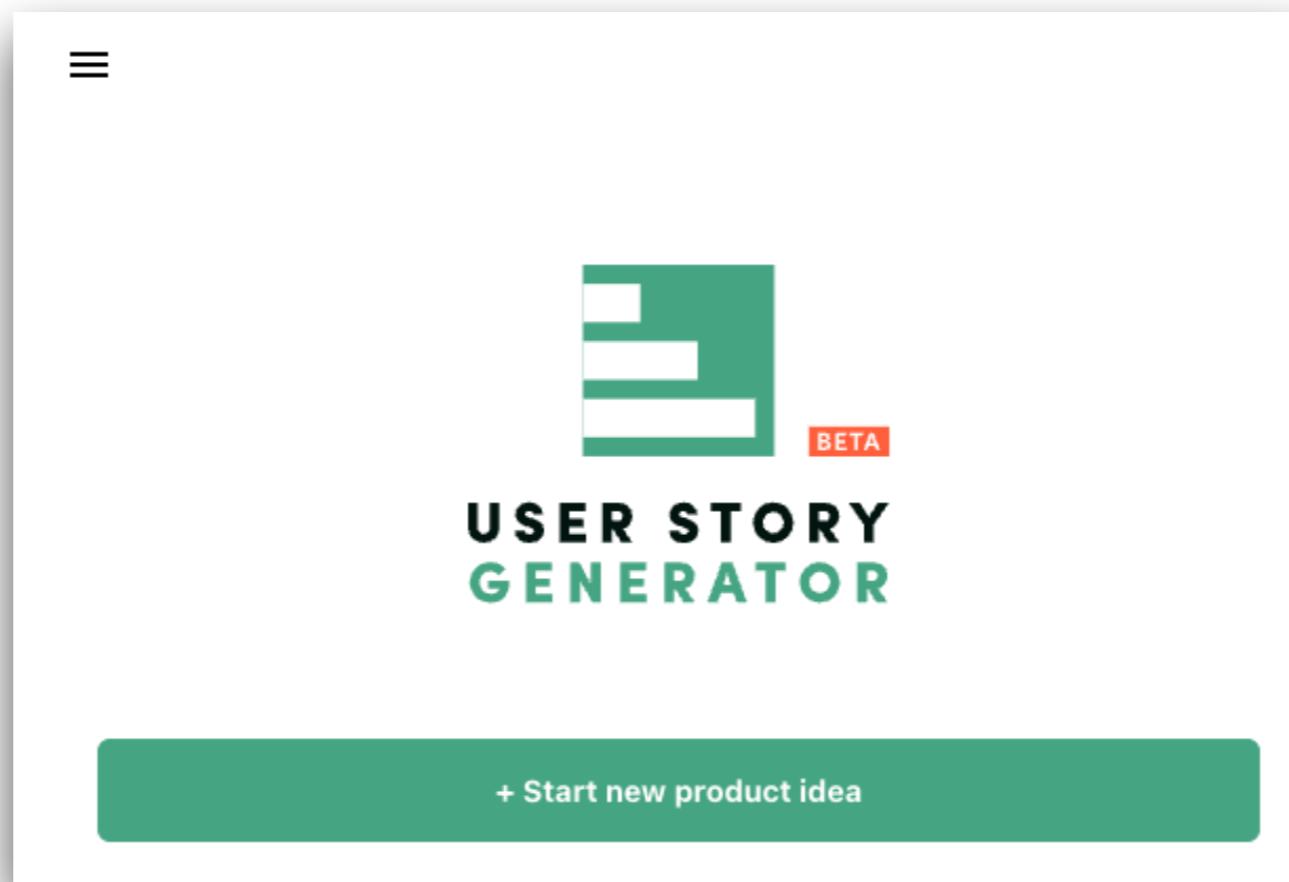
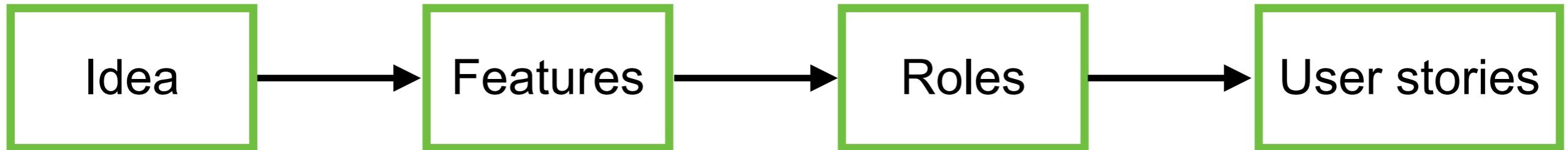
 Continue writing

 Make longer

<https://www.taskade.com/generate/project-management/agile-user-story>



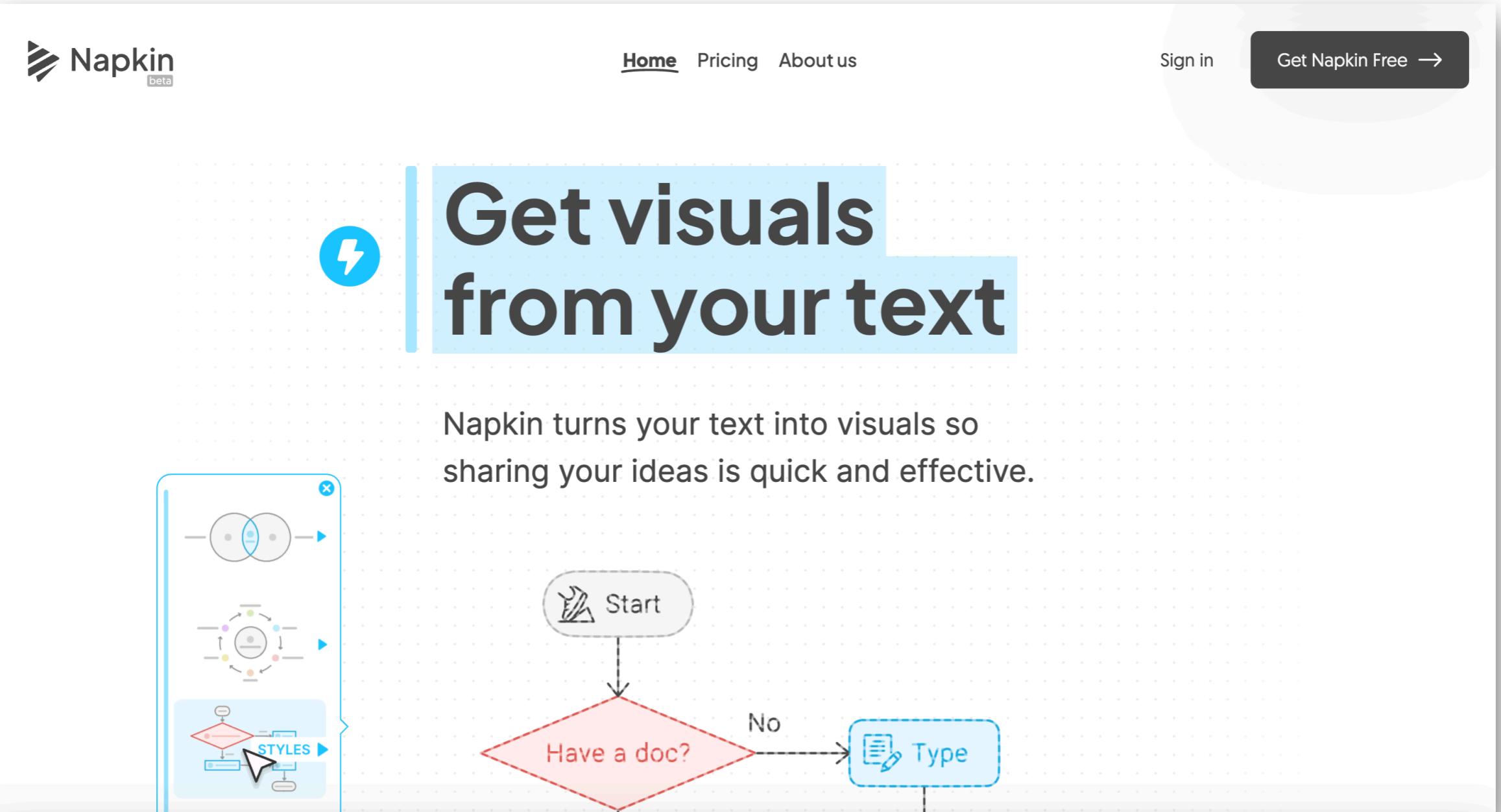
User Story Generator



<https://userstorygenerator.ai/>



Napkin



The image shows the Napkin AI homepage. At the top left is the Napkin logo with 'beta' underneath. To the right are navigation links: Home (underlined), Pricing, About us, Sign in, and a 'Get Napkin Free →' button. Below the navigation is a large blue header with a lightning bolt icon and the text 'Get visuals from your text'. A subtext below it reads: 'Napkin turns your text into visuals so sharing your ideas is quick and effective.' To the left of the subtext is a screenshot of the Napkin interface showing a flowchart editor with nodes like 'Start', 'Have a doc?', and 'Type'. To the right is a screenshot of a presentation slide featuring a flowchart with a decision diamond 'Have a doc?' and a process step 'Type'.

<https://www.napkin.ai/>



Requirement analysis

Clarify of User requirement ?

<https://github.com/up1/workshop-ai-with-technical-team/wiki/Requirement-analysis>



Design Process



Design

Requirement

Design

Develop

Testing

Deploy

Architecture writing assistance

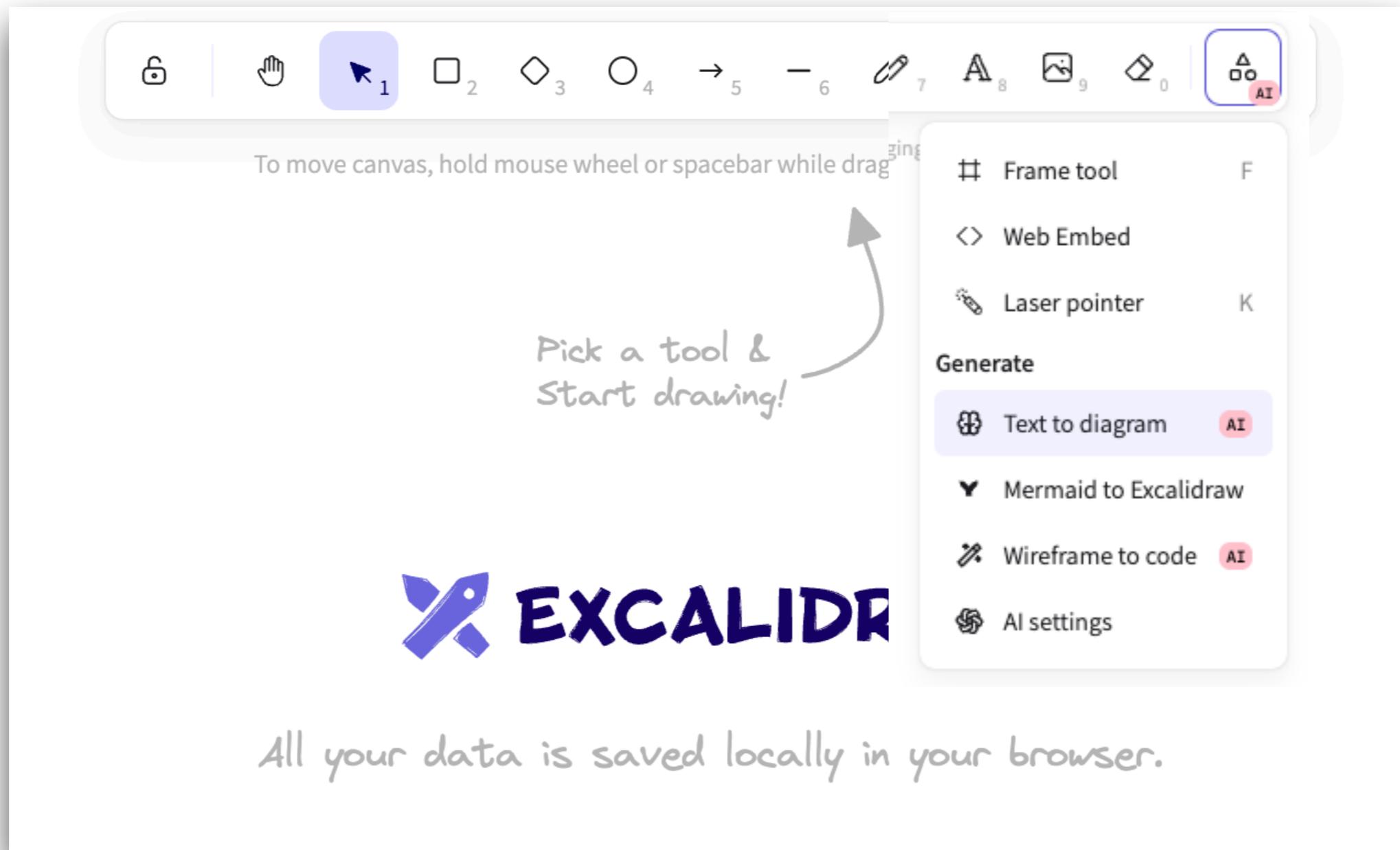
Sequence flow diagram generation

Data modeling

UX/UI design assistance



Excalidraw with AI



<https://excalidraw.com/>



Demo

[Text to diagram](#) AI Beta [Mermaid](#)

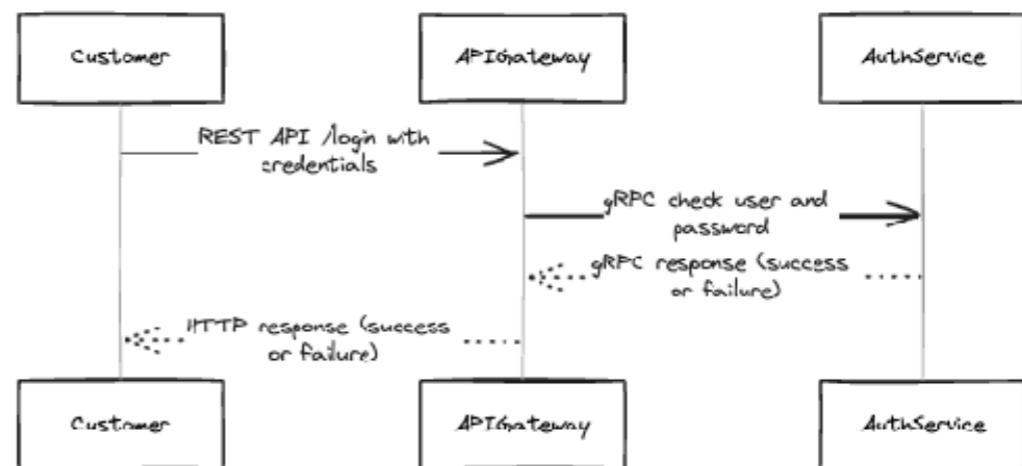
Currently we use Mermaid as a middle step, so you'll get best results if you describe a diagram, workflow, flow chart, and similar.

Prompt

9 requests left today

Try to generate authentication service from below
1. Customer call api gateway with REST API /login
2. Api gateway check user and password from auth service via gRPC
3. API gateway send response to client

Preview



[Generate →](#)

[Cmd](#) [Enter](#)

[View as Mermaid →](#)

[Insert →](#)



Database

The screenshot shows a database management interface with the following features and details:

- Header:** Includes a "New database" button, a "Diagram" tab (which is active), and a "Migrations" tab.
- Left sidebar:** Shows two database options: "User Management Database ..." and "User and Shipping Address ...".
- Central area:** Displays two tables:
 - shipping_addresses**: Contains columns for id (int8), user_id (int8), address_line1 (text), address_line2 (text), city (text), state (text), postal_code (text), and country (text).
 - users**: Contains columns for id (int8), name (text), and email (text).
- Bottom navigation:** Includes a "PG 16 | Local-only database" indicator, a "Toggle theme" button, and a toolbar with icons for Primary key, Identity, Unique, and Nullable.
- Right panel:** Contains a summary message: "Create table of user that have many shipping address" and a "Executed SQL" dropdown. Below it, a note states: "The tables `users` and `shipping_addresses` have been created successfully. Here's a brief overview:" followed by a bulleted list of table details.
- Bottom right:** A "Message AI or write SQL" input field with a send button.

<https://database.build/>



Magic Pattern

The screenshot shows the Magic Patterns web application interface. At the top, there is a navigation bar with links for "Magic Patterns", "Use Cases", "Customers", "Catalog", "Feedback", and a user profile icon. The main heading "Prototype your product ideas with AI." is displayed prominently. Below it, a subtext reads "Iterate on components & designs in our AI-native editor. Export to React or Figma." Three buttons are visible: "Generate a new UI", "Add a new feature to an existing UI" (which is highlighted in blue), and "Apply a theme to an existing UI". The central feature is a large input form divided into three sections: "Import your existing UI" (with a dashed box for "Add an image or screenshot"), "Describe what to add to the existing UI" (with a text input field for "e.g. add an error state" and a dashed box for "(Optional) Include an image"), and a "Generate" button.

<https://www.magicpatterns.com/>



Make Real

Intelligence Report System

ต้องการข้อมูลอะไร ?

Send

Search results

Row 1

Row 2

Row 3

Intelligence Report System

ต้องการข้อมูลอะไร ?

sesdf

Send

Search Results

3 results found

- Intelligence Report #001**
Comprehensive analysis of market trends and competitive intelligence data for Q4 2024.
Dec 15, 2024 Analyst Team A High Priority
- Security Assessment Report**
Detailed security vulnerability assessment and threat analysis for enterprise systems.
Dec 12, 2024 Security Team Critical
- Operational Intelligence Summary**
Monthly operational metrics and performance indicators with strategic recommendations.
Dec 10, 2024 Operations Team Stand Double click to interact

<https://github.com/tldraw/make-real>



v0.dev

The screenshot displays the v0.dev platform's interface, featuring a navigation bar at the top with a logo, a "Private Beta" button, and several links: "Product categories ↗", "Hero section ↗", "Contact form ↗", and "Ecommerce dashboard ↗". Below the navigation, there are two tabs: "New Generations" (selected) and "Featured". The main area shows a grid of UI prototypes. Annotations with avatars and text are placed under specific cards:

- A card for a "Soccer Game" has an annotation: "page for a soccer game,..."
- A card for "Enhance Your Education Journey" has an annotation: "A hero section for a..."
- A card for a "Monochromatic Site" has an annotation: "A website in a black and..."
- A card for a "product tour like appcues" has an annotation: "product tour like appcues"
- Below the grid are two more cards: one for "Chats" and one for "Products".

<https://v0.dev/>



Bolt.new

What do you want to build?

Prompt, run, edit, and deploy full-stack web apps.

How can Bolt help you today?



Start a blog with Astro

Build a mobile app with NativeScript

Create a docs site with Vitepress

Scaffold UI with shadcn

Draft a presentation with Sliddev

Code a video with Remotion

or start a blank app with your favorite stack



<https://bolt.new/>



Lovable



Idea to app in seconds.

Lovable is your superhuman full stack engineer.

Login form with email and password

⚙️ Configure

🌐 Public



<https://lovable.dev/>



Val Town

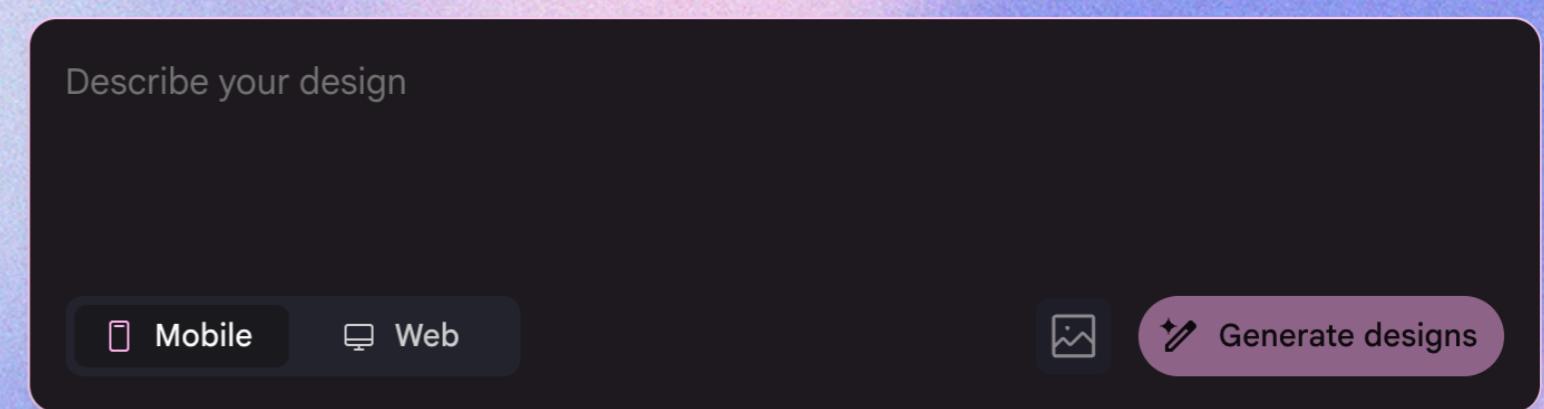
The screenshot shows a web-based application interface for managing code snippets. At the top, there's a navigation bar with a search icon, a 'New' button, and a user profile icon. Below the navigation, a header bar shows the project name 'val town' and the URL 'up1/zanyTomatoLamprey'. A dark sidebar on the left contains a snippet titled 'up1/zanyTomatoLamprey version 1'. The main content area has a title 'This code creates a login form with username and password fields. It uses React for the client-side interface and includes server-side handling for login attempts using SQLite for user storage and verification. The form is styled for better usability and includes labels for each input field. A message is displayed after login attempts, and there's a link to view the source code.' Below this, a blue button says 'add forgot password link'. Another sidebar shows a snippet titled 'version 2' with a timestamp '58s ago'. The main content area for version 2 includes a note about adding a 'Forgot Password' link, a list of steps (1. This is an edit to the existing code., 2. Changes required: - Add a "Forgot Password" link to the LoginForm component - Update the CSS to style the new link - Add a placeholder handler for the "Forgot Password" functionality, 3. The response will be in the entire val format.), and a note that the 'password reset functionality not implemented yet.' A 'View Source' link is also present. At the bottom, there are buttons for 'Reply to Townie', 'Logs', and 'Requests'.

<https://www.val.town/>



Google Stitch

Design at the Speed of AI



Transform ideas into UI designs for mobile and web applications.

<https://stitch.withgoogle.com/>



Development Process



Develop

Requirement

Design

Develop

Testing

Deploy

Code generation

Review and explain code

Debugging code

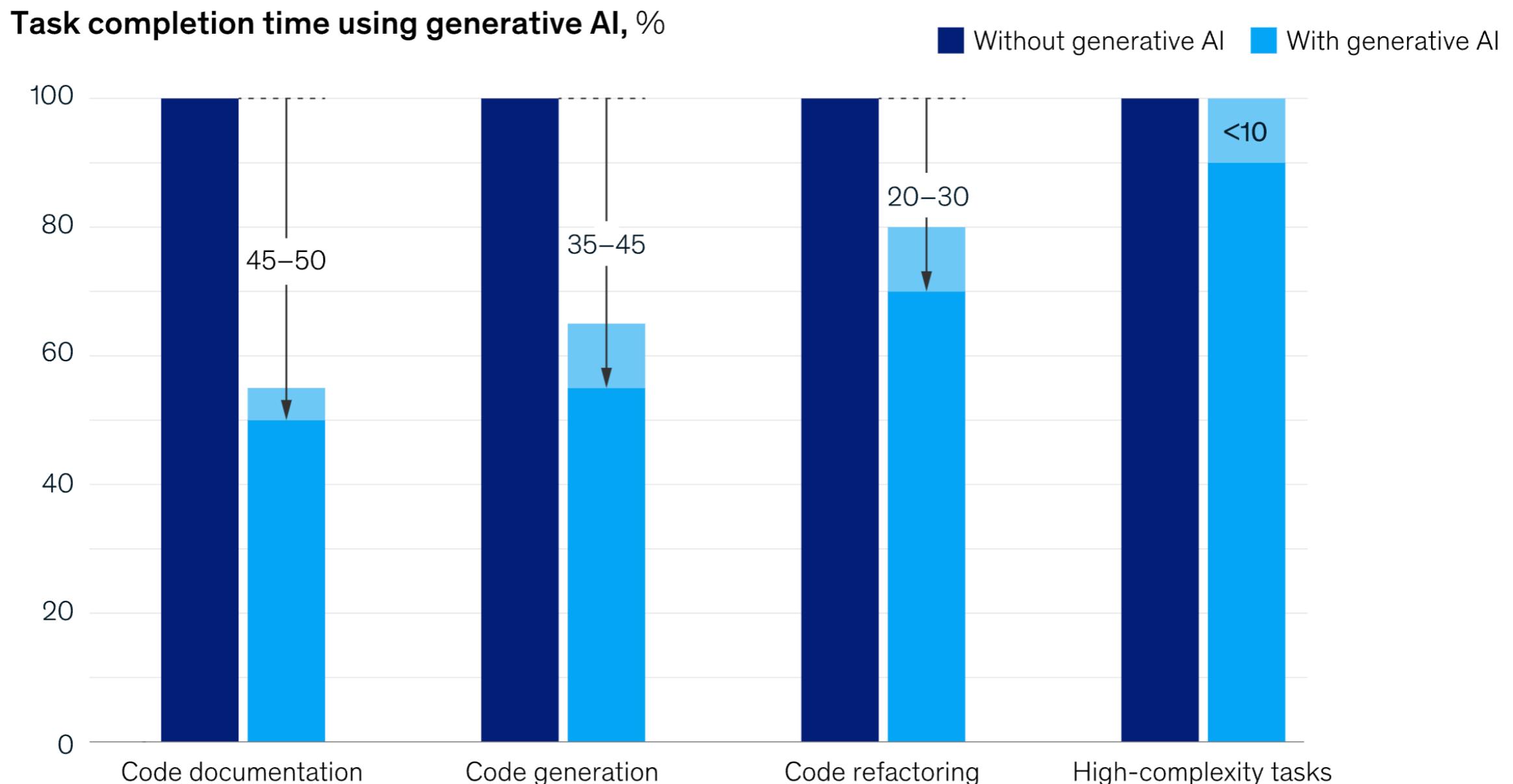
Improve consistency

Code translation



Development

Generative AI can increase developer speed, but less so for complex tasks.



<https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/unleashing-developer-productivity-with-generative-ai>



Category of Tools

Chat AI

ChatGPT
Gemini
Claude.ai
DeepSeek

Code AI

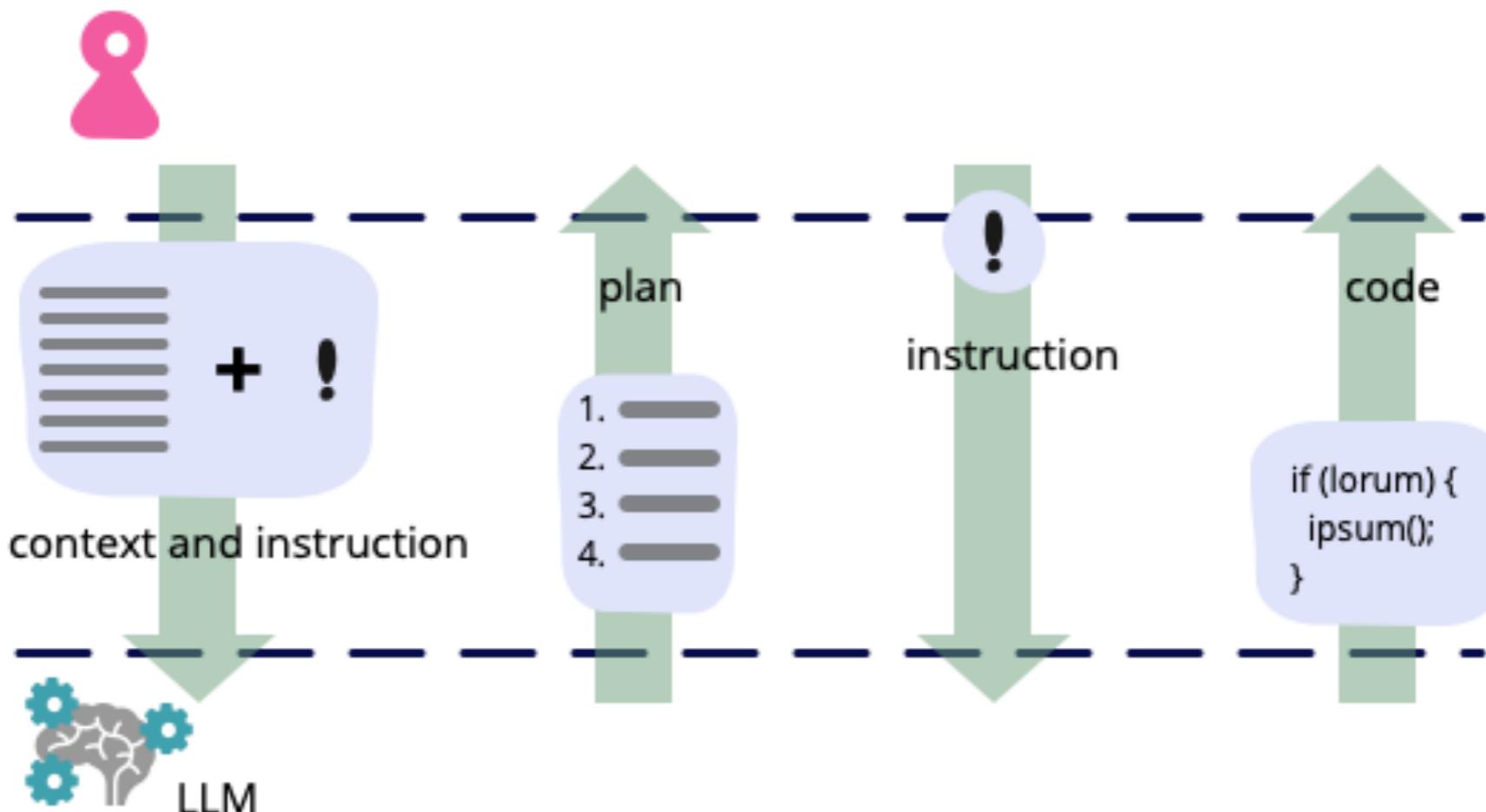
Copilot in VSCode
Cursor IDE
Windsurf
Zed

AI Agent
Public and Local

Aider
Claude code
Gemini CLI
Codex CLI
Qwen3-coder



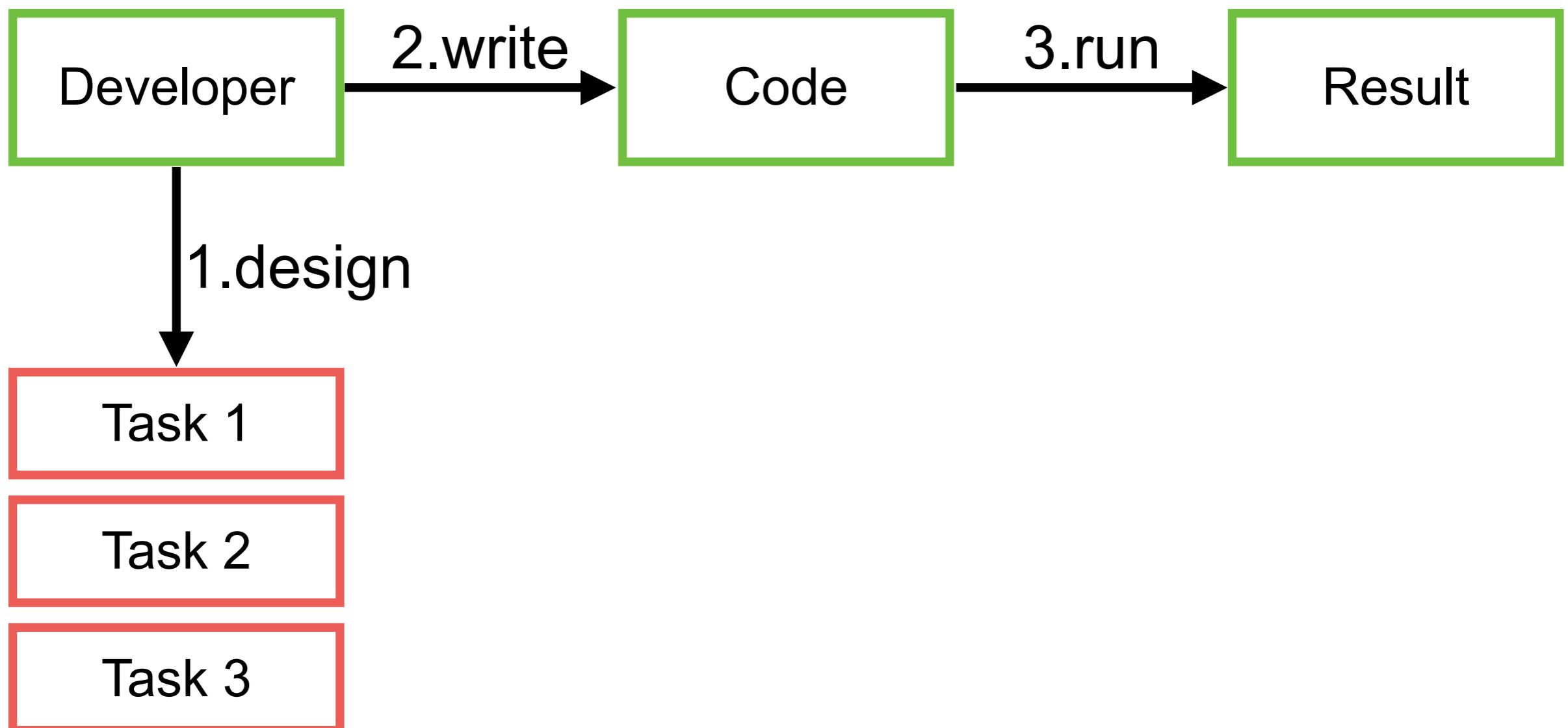
Development



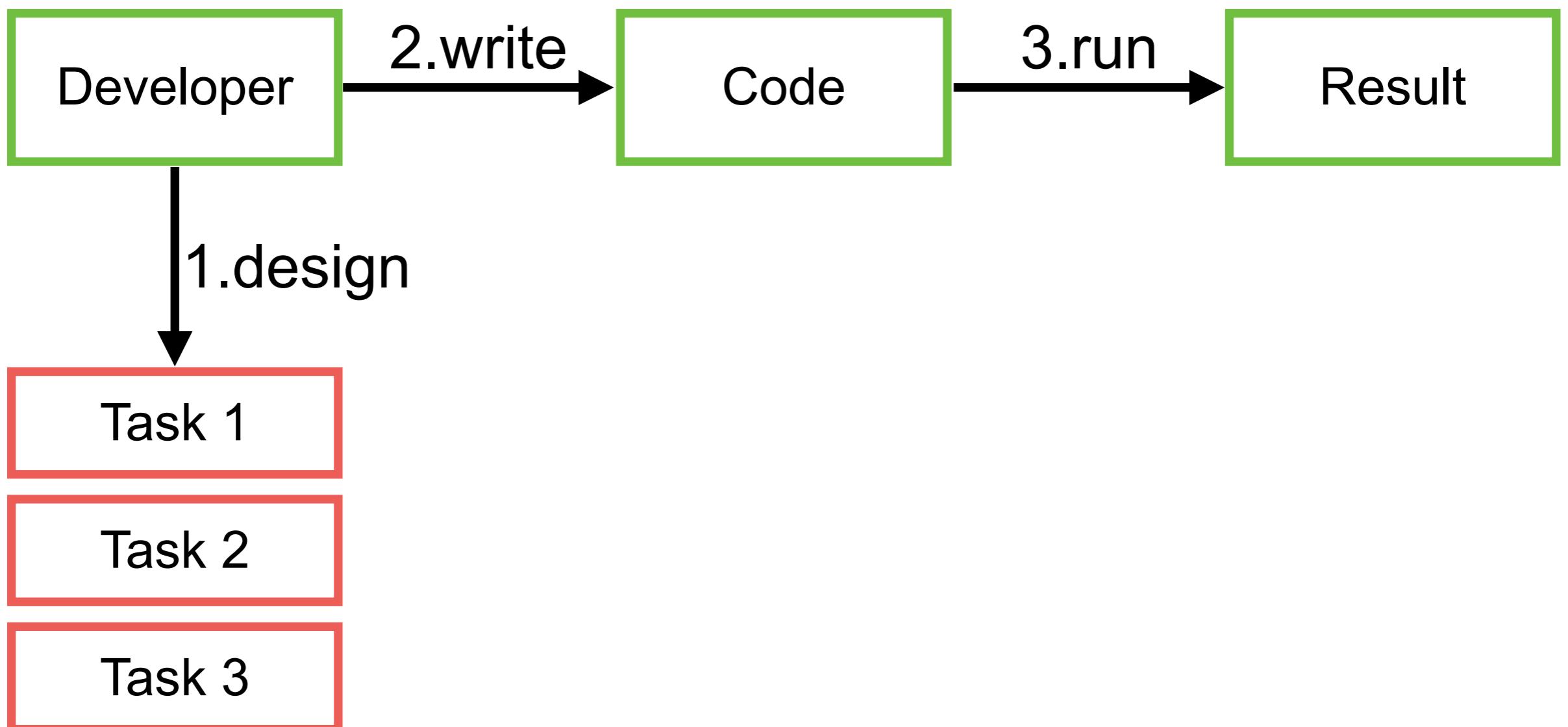
<https://martinfowler.com/articles/2023-chatgpt-xu-hao.html>



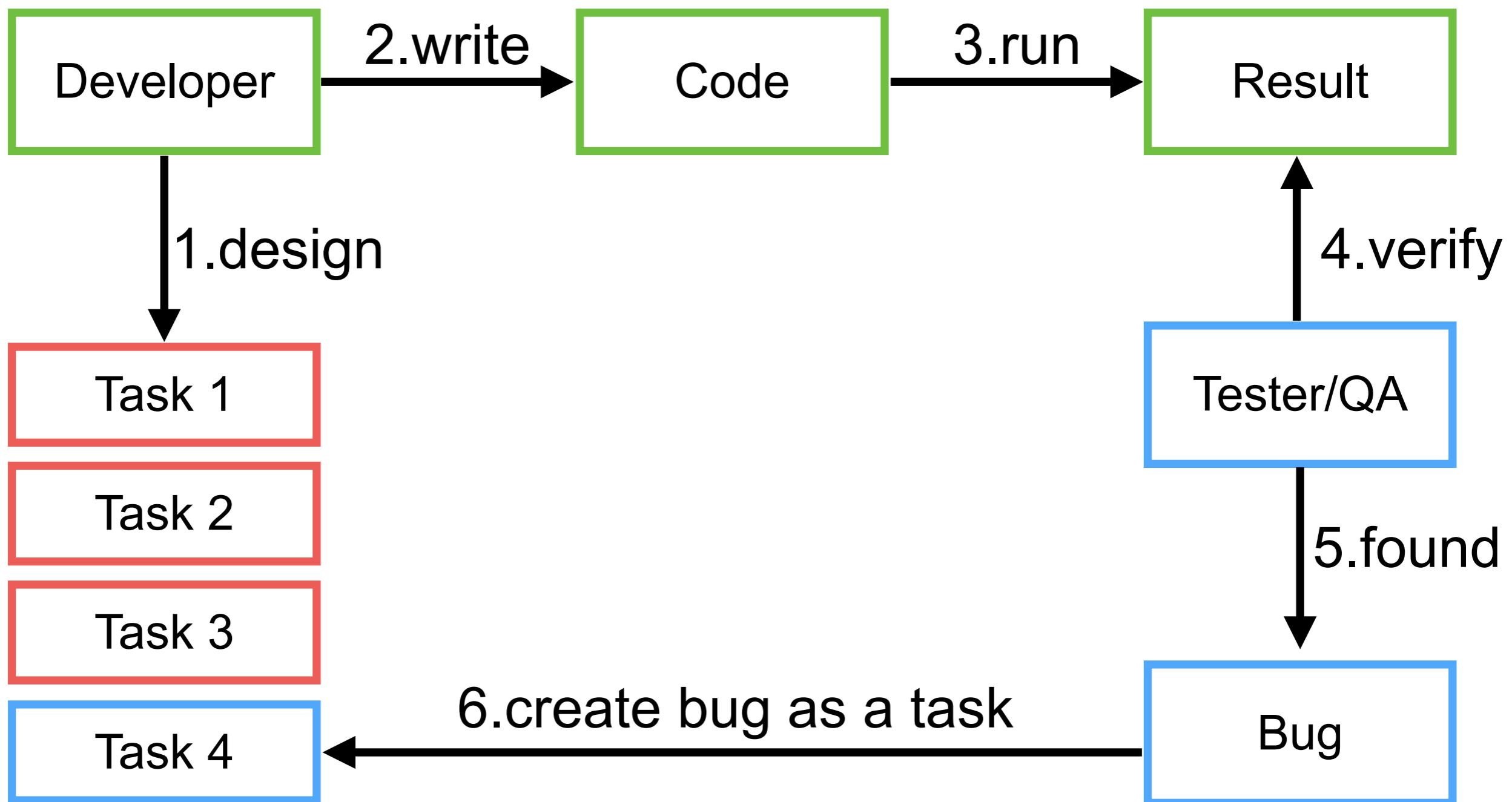
Development



Development



Development + Testing



Main Features

Ask question

Generate code

Refactor code

Document code

Find problems in your code



Pair programming with AI



AI Pair Programming

Aider is AI pair programming in your terminal

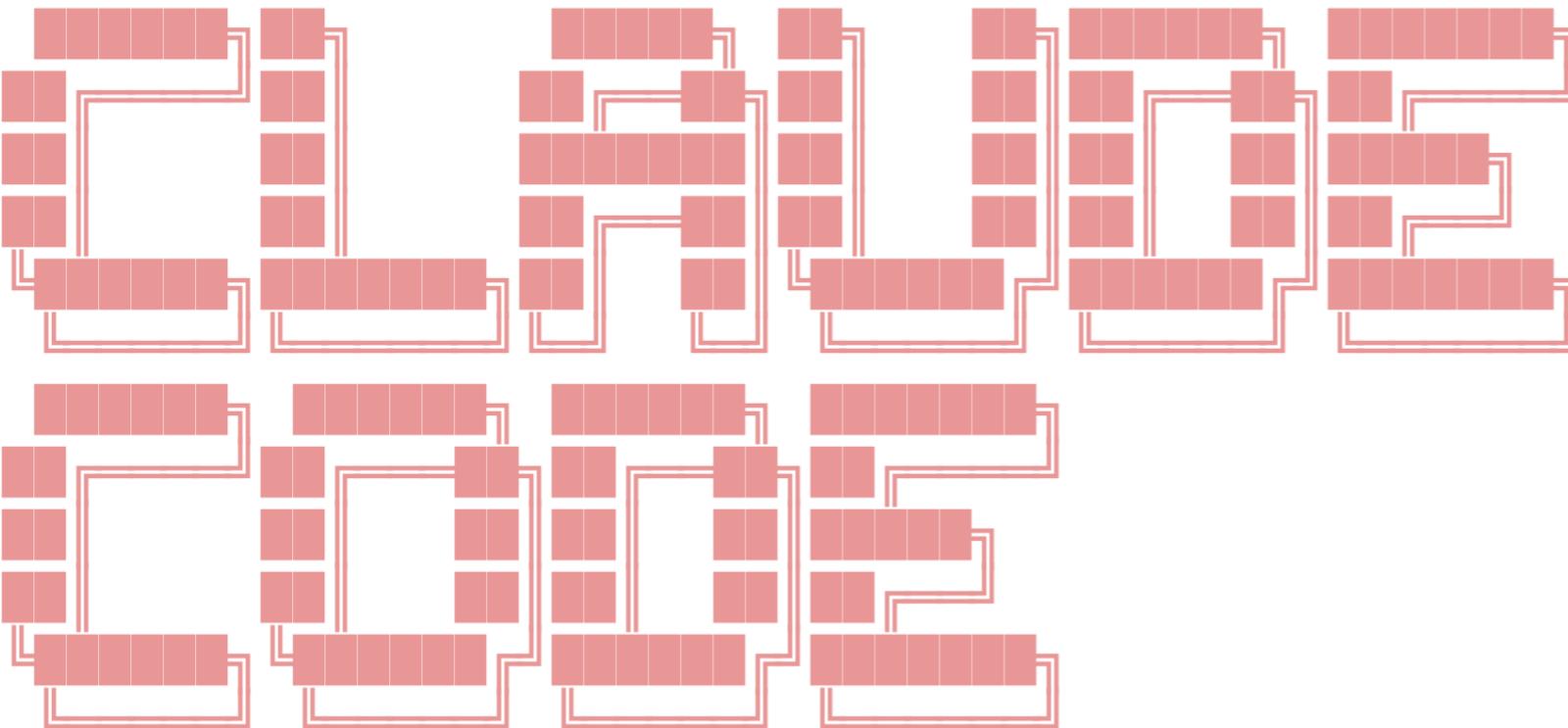
Aider lets you pair program with LLMs, to edit code in your local git repository. Start a new project or work with an existing git repo. Aider works best with GPT-4o & Claude 3.5 Sonnet and can [connect to almost any LLM](#).



<https://github.com/paul-gauthier/aider>



* Welcome to **Claude Code** research preview!



Claude Code is billed based on API usage through your Anthropic Console account.

Pricing may evolve as we move towards general availability.

Press **Enter** to login to your Anthropic Console account...

2025/02

<https://www.anthropic.com/news/clause-3-7-sonnet>





2025/06

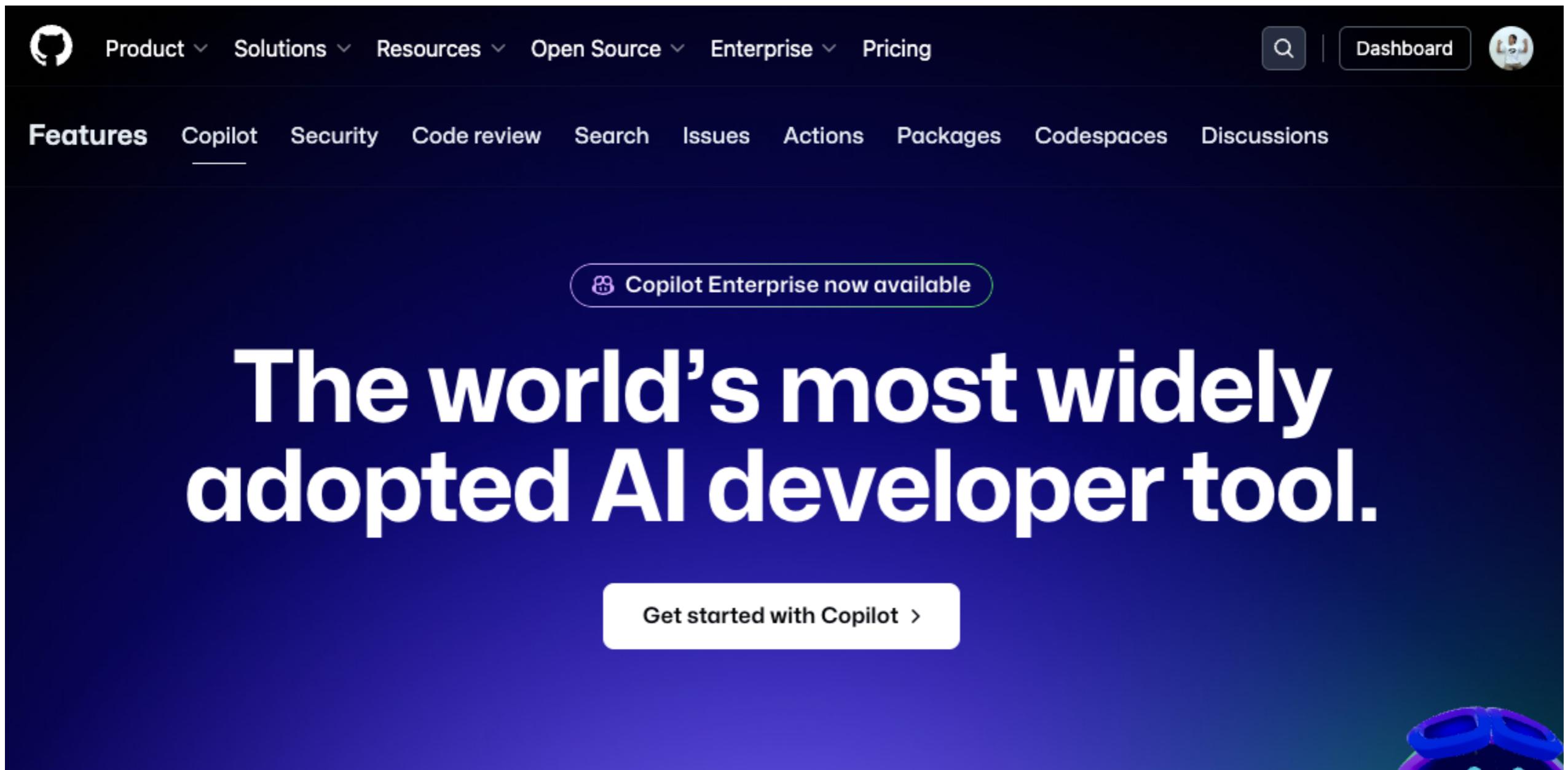
<https://github.com/google-gemini/gemini-cli>



AI in IDE



GitHub Copilot



The screenshot shows the GitHub Copilot landing page. At the top, there's a navigation bar with links for Product, Solutions, Resources, Open Source, Enterprise, Pricing, a search bar, a dashboard button, and a user profile icon. Below the navigation is a secondary navigation bar with links for Features, Copilot (which is underlined), Security, Code review, Search, Issues, Actions, Packages, Codespaces, and Discussions. A callout bubble in the center says "Copilot Enterprise now available". The main headline is "The world's most widely adopted AI developer tool." followed by a "Get started with Copilot >" button. In the bottom right corner, there's a small, stylized blue robot head icon.

Product Solutions Resources Open Source Enterprise Pricing

Copilot Security Code review Search Issues Actions Packages Codespaces Discussions

Copilot Enterprise now available

The world's most widely adopted AI developer tool.

Get started with Copilot >

<https://github.com/features/copilot>



Cursor.sh



CURSOR

Pricing

Features

Forum

Docs

Careers

Blog

Sign In

Download

The AI Code Editor

Built to make you extraordinarily productive, Cursor is the best way to code with AI.



Download for Free



Watch Demo
1 Minute

<https://www.cursor.com/>



AI for Software Development

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100

Cursor Directory

cursor.directory

Get latest updates [Subscribe](#)

Live Learn About

Search... Q All Popular

Topic	Count
TypeScript	15
Python	9
Next.js	9
React	9
PHP	5
C#	4
Expo	4
React Native	4
Tailwind	4
Supabase	4
Web Development	3
Game Development	3
JavaScript	3
Laravel	3

TypeScript

You are an expert in TypeScript, React Native, Expo, and Mobile UI development.

Code Style and Structure

- Write concise, technical TypeScript code.
- Use functional and declarative programming patterns; avoid classes.
- Prefer iteration and modularization over code duplication.
- Use descriptive variable names with auxiliary verbs (e.g., isLoading, hasError).
- Structure files: exported component, subcomponents, helpers, static content, etc.
- Follow Expo's official documentation for best practices.

Krish Kalaria 🇮🇳

expo-router expo-status-bar +7 more ▾

Mohammadali Karimi

Tailwind CSS Shadcn UI +1 more ▾

Nathan Brachotte

gatsby react +2 more ▾

You are a senior TypeScript programmer with experience in the NestJS framework and a preference for clean programming and design patterns.

Generate code corrections and suggestions

Submit +

<https://cursor.directory/>



Windsurf by Codeium



Built to keep you in *flow state*

The first agentic IDE, and then some. The Windsurf Editor is where the work of developers and AI truly flow together, allowing for a coding experience that feels like literal magic.

 Download the Windsurf Editor

See all download options

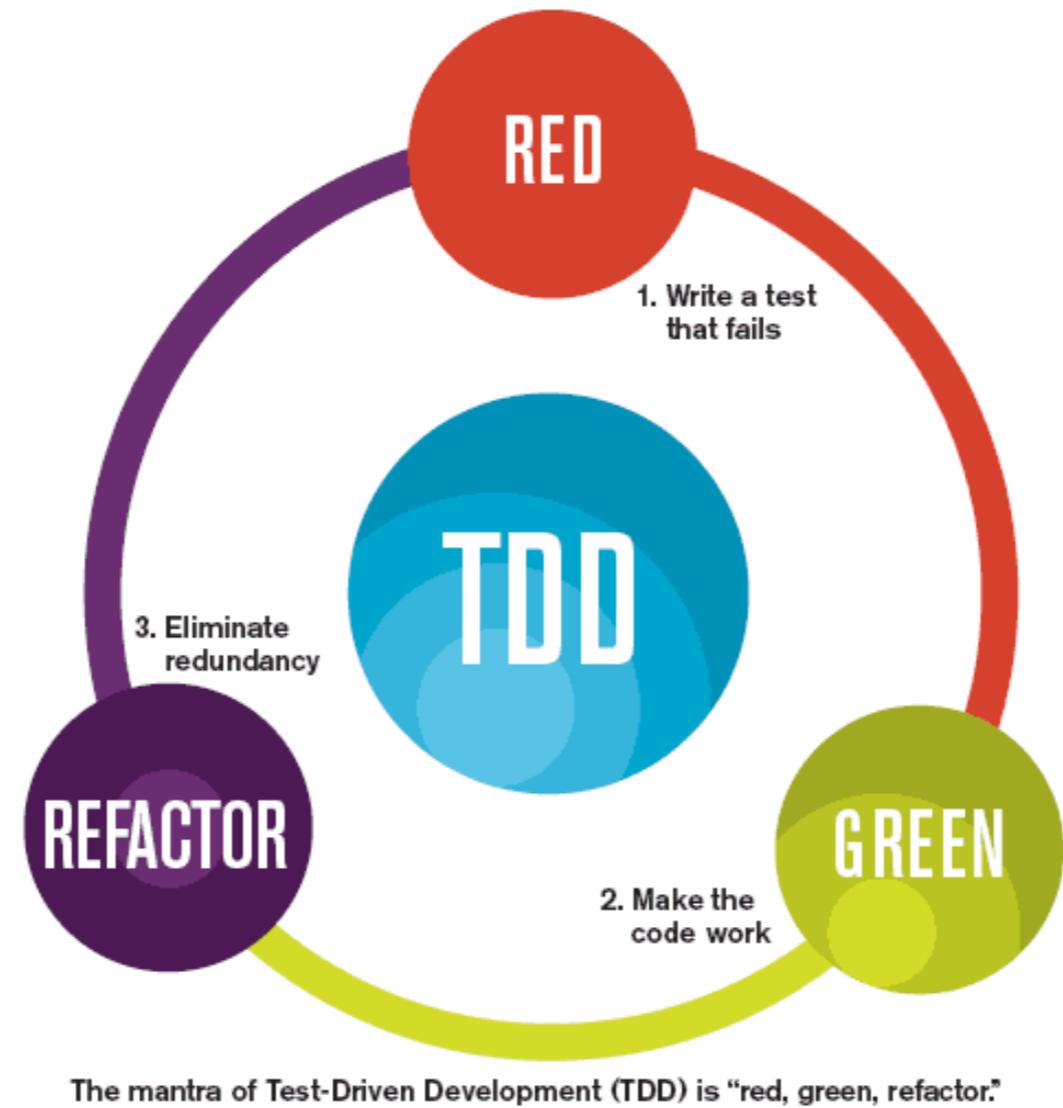
<https://codeium.com/windsurf>



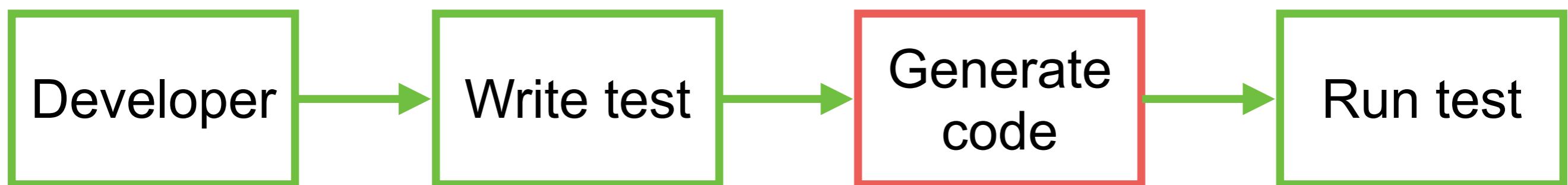
Test-Driven Development



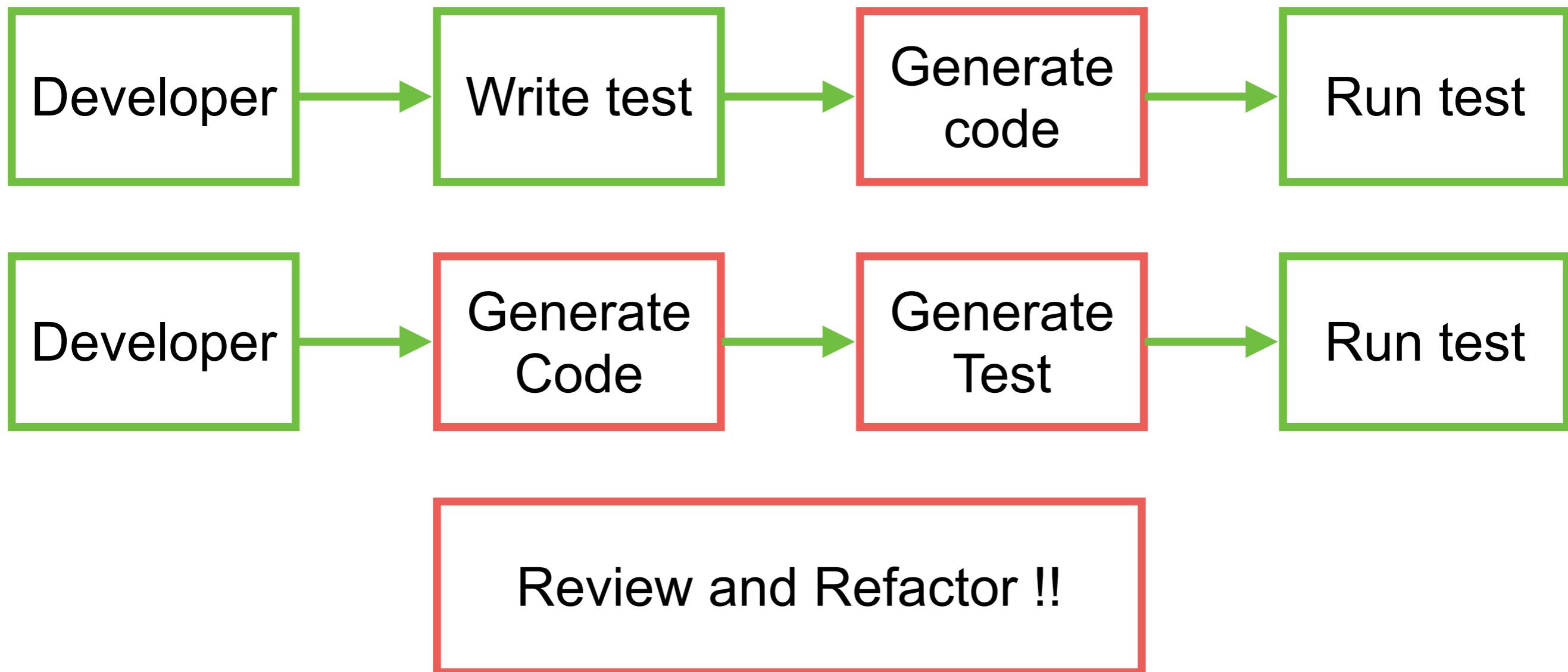
Test-Driven-Development



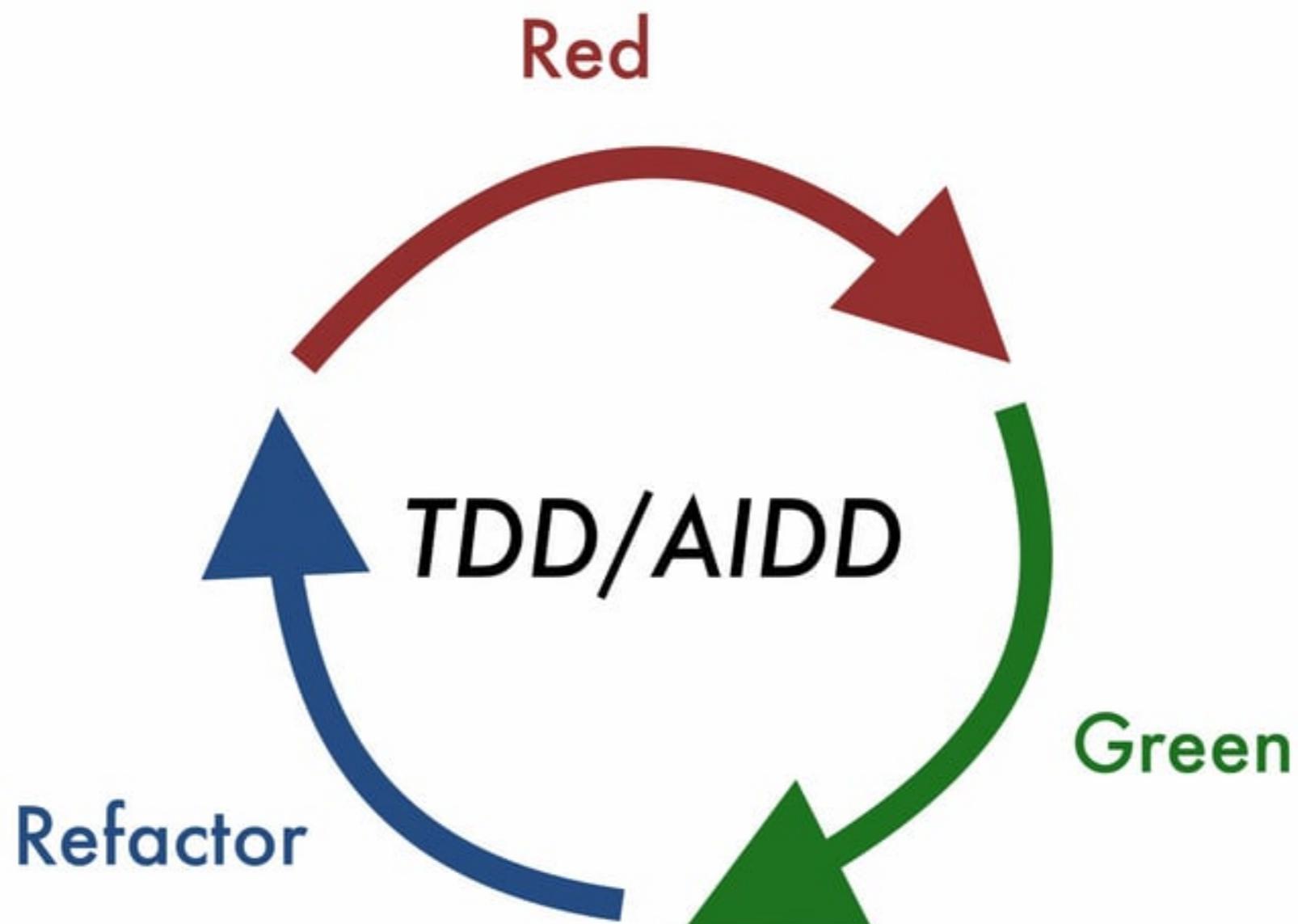
Test-Driven-Development



Test-Driven-Development



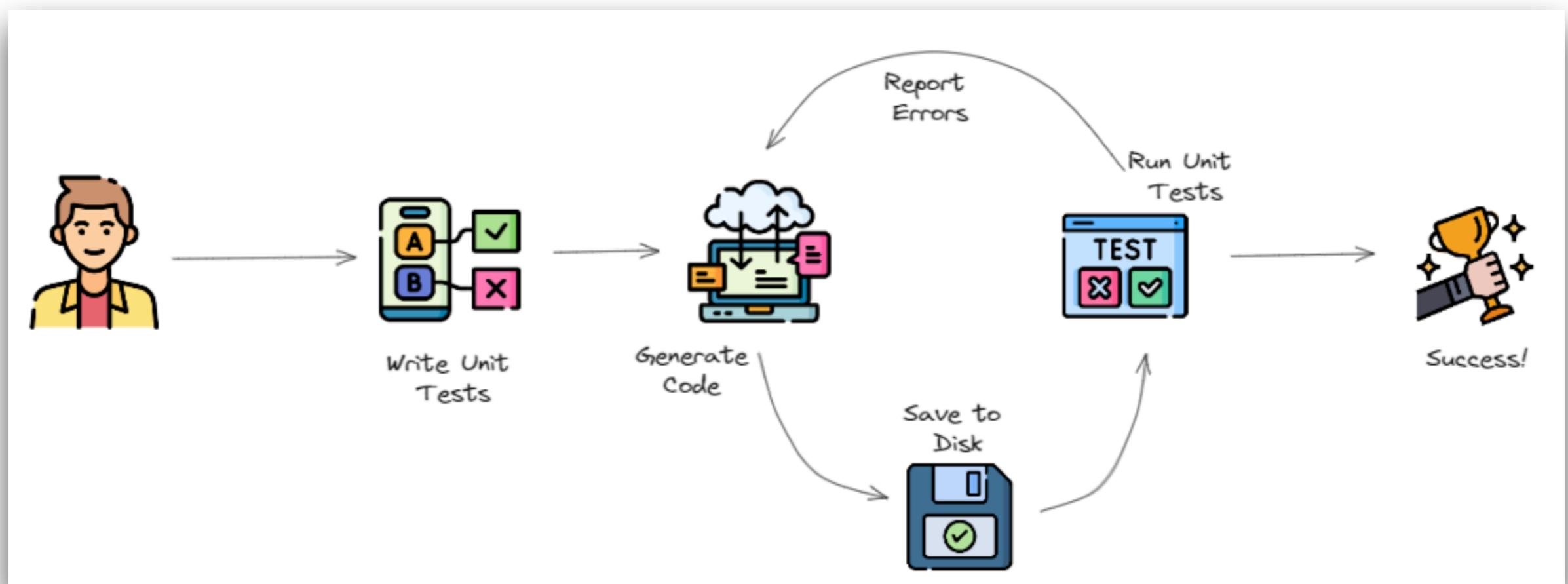
AI-DD



<https://dev.to/dawiddahl/ai-is-changing-the-way-we-code-ai-driven-development-aidd-2ngo>



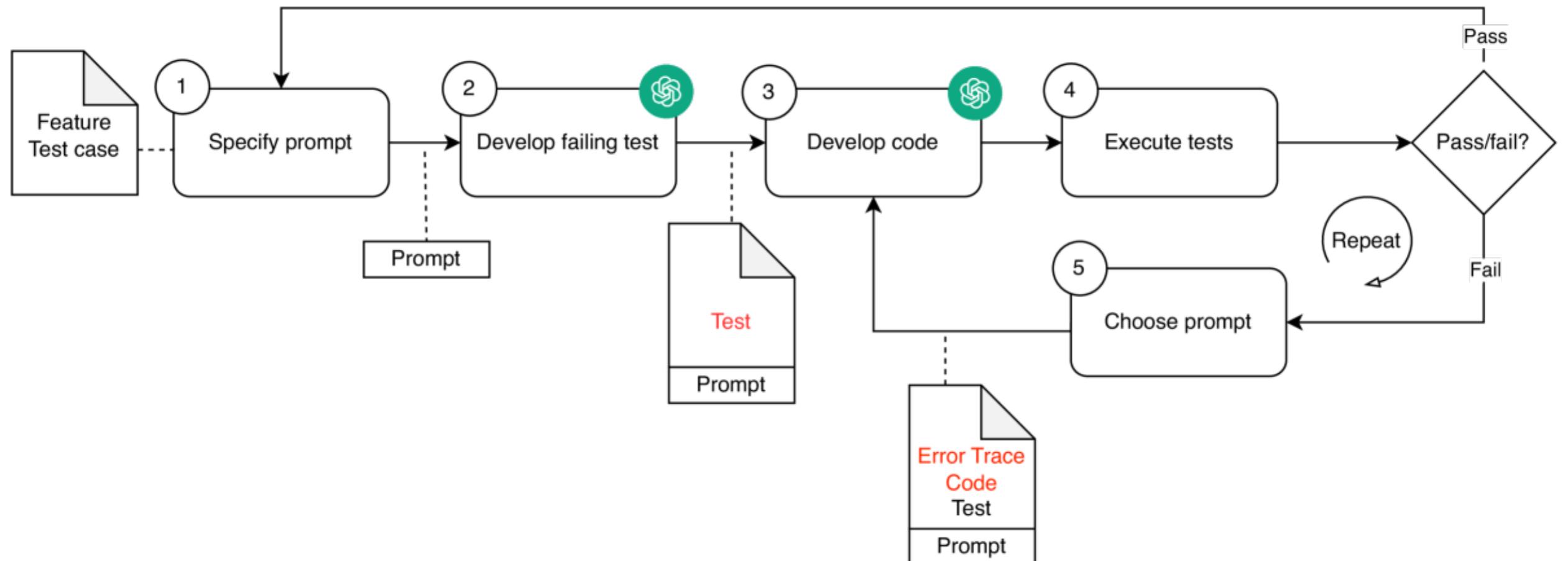
TDD with AI



<https://github.com/allenheltondev/tdd-ai>



TDD with AI



<https://arxiv.org/html/2405.10849v1>



Test-Driven-Generation (TDG)



Test-Driven-Generation (TDG)

Development practice that integrate Generative AI into the development life-cycle

TDD

+

Pair
programming

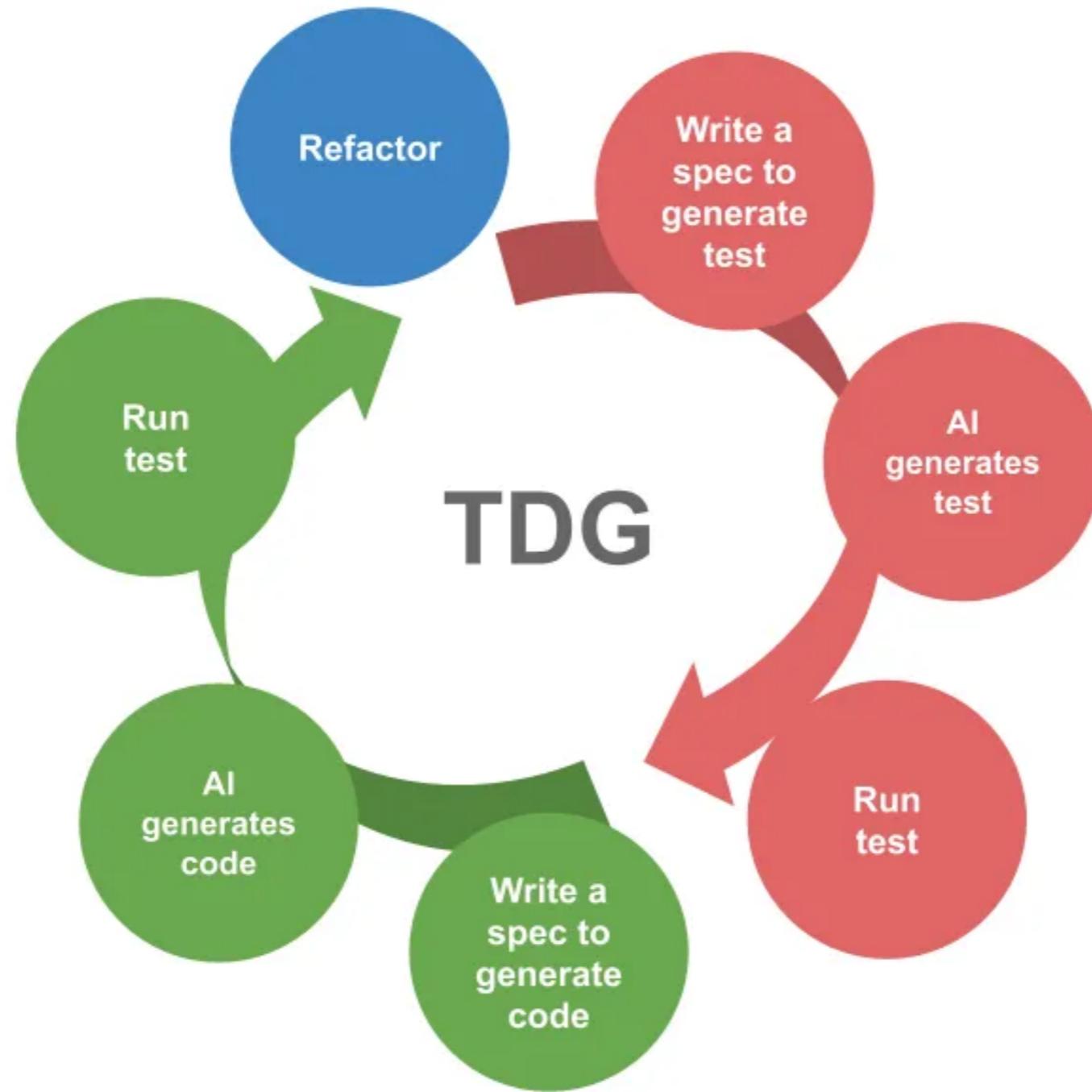
+

Generative AI

<https://chanwit.medium.com/test-driven-generation-tdg-adopting-tdd-again-this-time-with-gen-ai-27f986bed6f8>



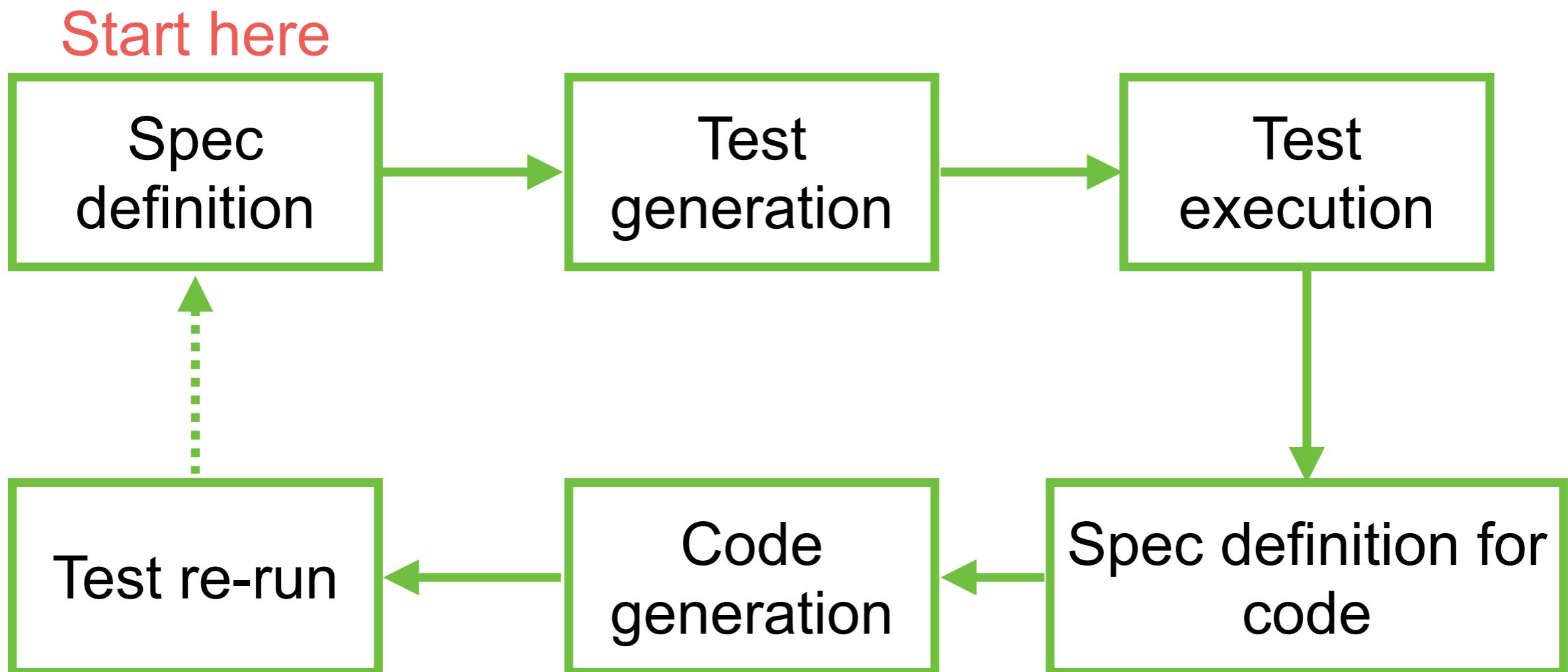
Test-Driven-Generation (TDG)



<https://chanwit.medium.com/test-driven-generation-tdg-adopting-tdd-again-this-time-with-gen-ai-27f986bed6f8>



Test-Driven-Generation (TDG)



Tips and Techniques with AI

Scope of prompt

Error in result

Setup and config
project

Latest information

Use technical
keywords



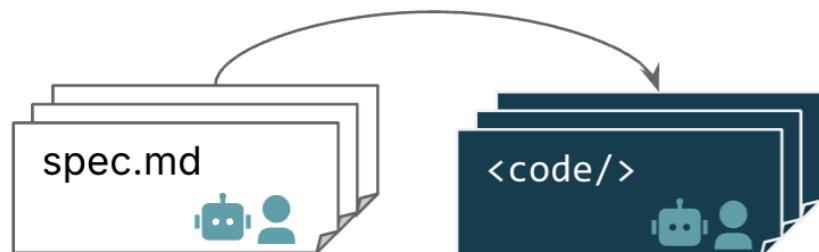
Specification-Driven Development (SDD)



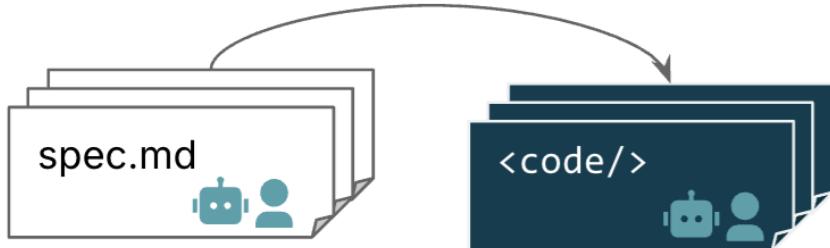
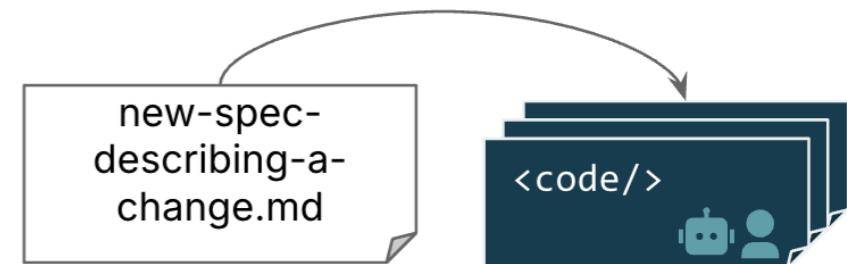
Workflow SDD

Levels of “spec-driven”

Creation of feature



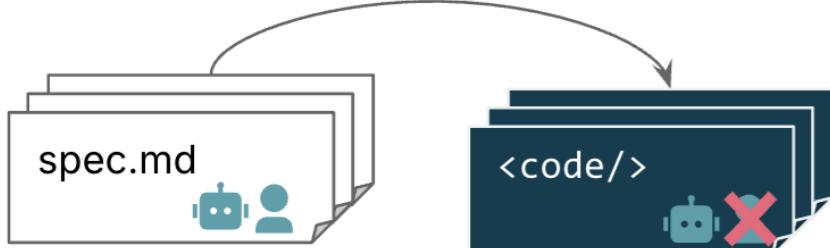
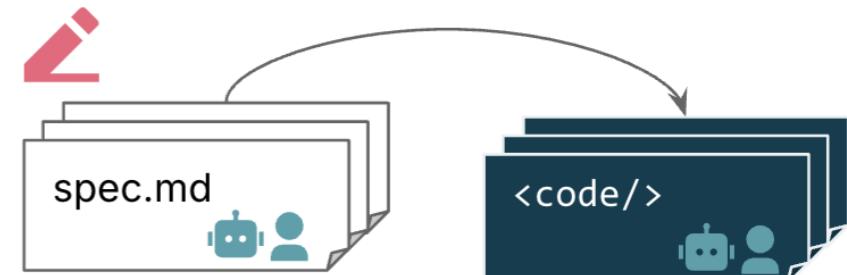
Evolution and maintenance of feature



spec-first

spec-anchored

spec-as-source

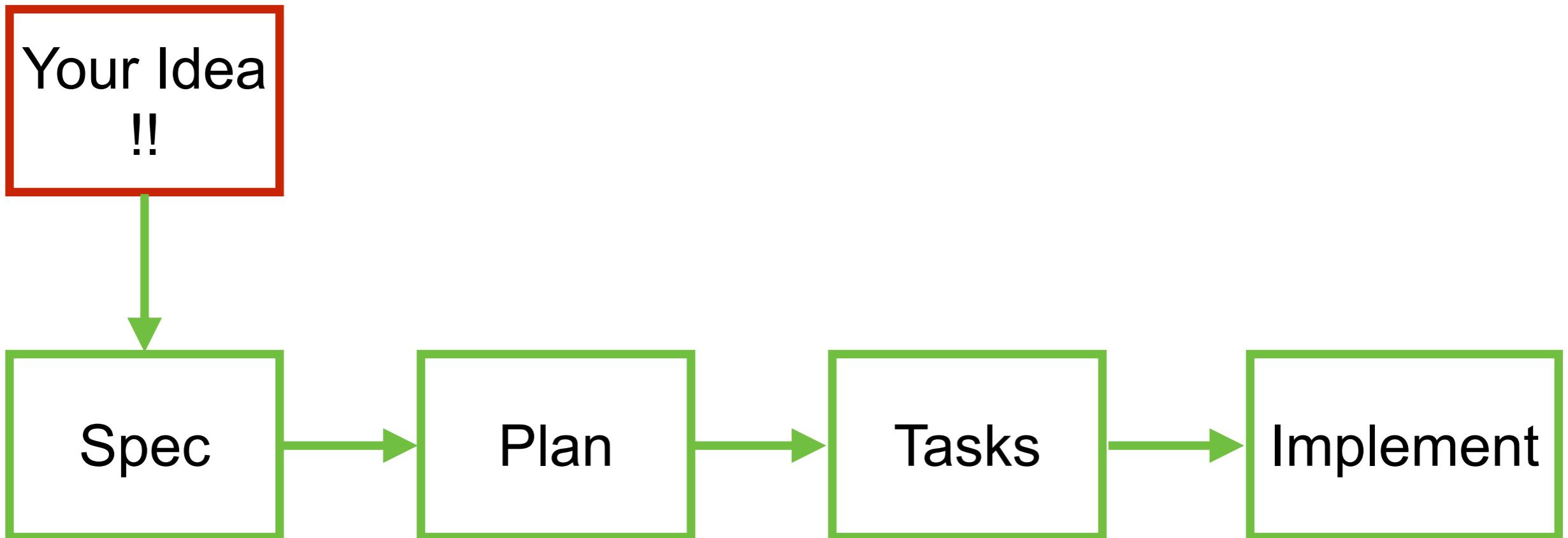


<https://martinfowler.com/articles/exploring-gen-ai.html>

<https://martinfowler.com/articles/exploring-gen-ai/sdd-3-tools.html>



Workflow SDD



Memory Bank

Memory bank

AGENTS.md

project.md

architecture.md

*Examples for illustration,
actual file structures vary*

Agent

Specs

STORY-
324.md

STORY-
525.md

product-
search.md

config-
loader.md

feature-x

data-mo
del.md

plan.
md

contr
acts

*Examples for illustration,
actual file structures vary*



Workflow Tools

AWS Kiro

Spec-kit

Custom by IDE

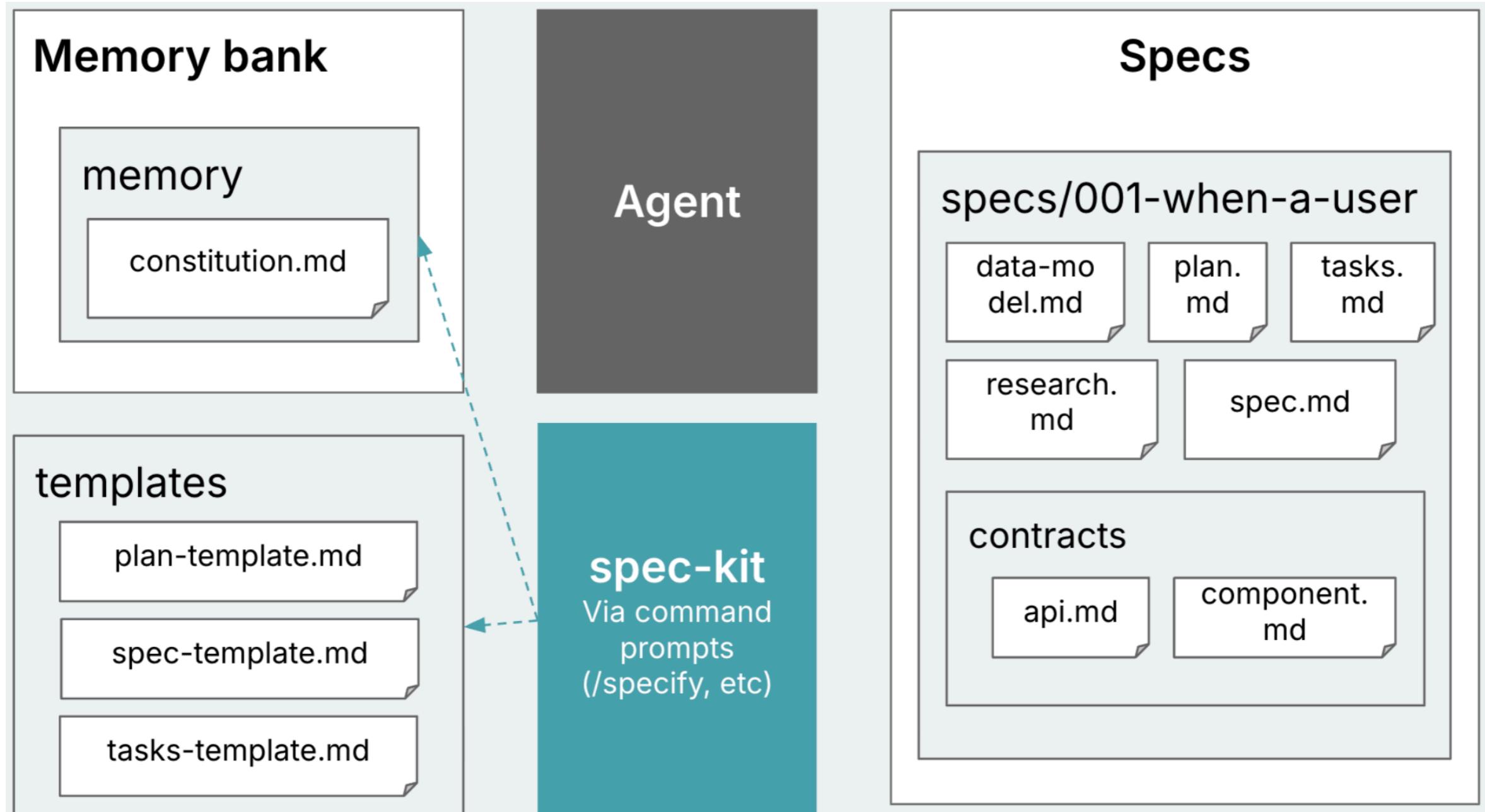
Requirement
Design
Tasks

Specify
Plan
Tasks

VSCode rules
Cursor rules
Github rules



Spec-Kit



Workshop with Coding

Chat

Text Editor with AI

Pair programming
with AI

SDD and Rules

BMAD-METHOD



Pair programming with AI

GPT-5

Claude 4.5
Sonnet

DeepSeek
Coder

Llama

<https://github.com/up1/workshop-ai-with-technical-team/tree/main/workshop/aider>



Testing Process

with High quality process

Functional

Non-Functional



Testing

Requirement

Design

Develop

Testing

Deploy

Test cases writing
Test code generation
Bug detection
Test planning
Data test generation



6 Keys Software Quality

Defect density

Code duplication

Hardcode token/key

Security
vulnerabilities

Outdated package

Non-permissive
opensource libraries

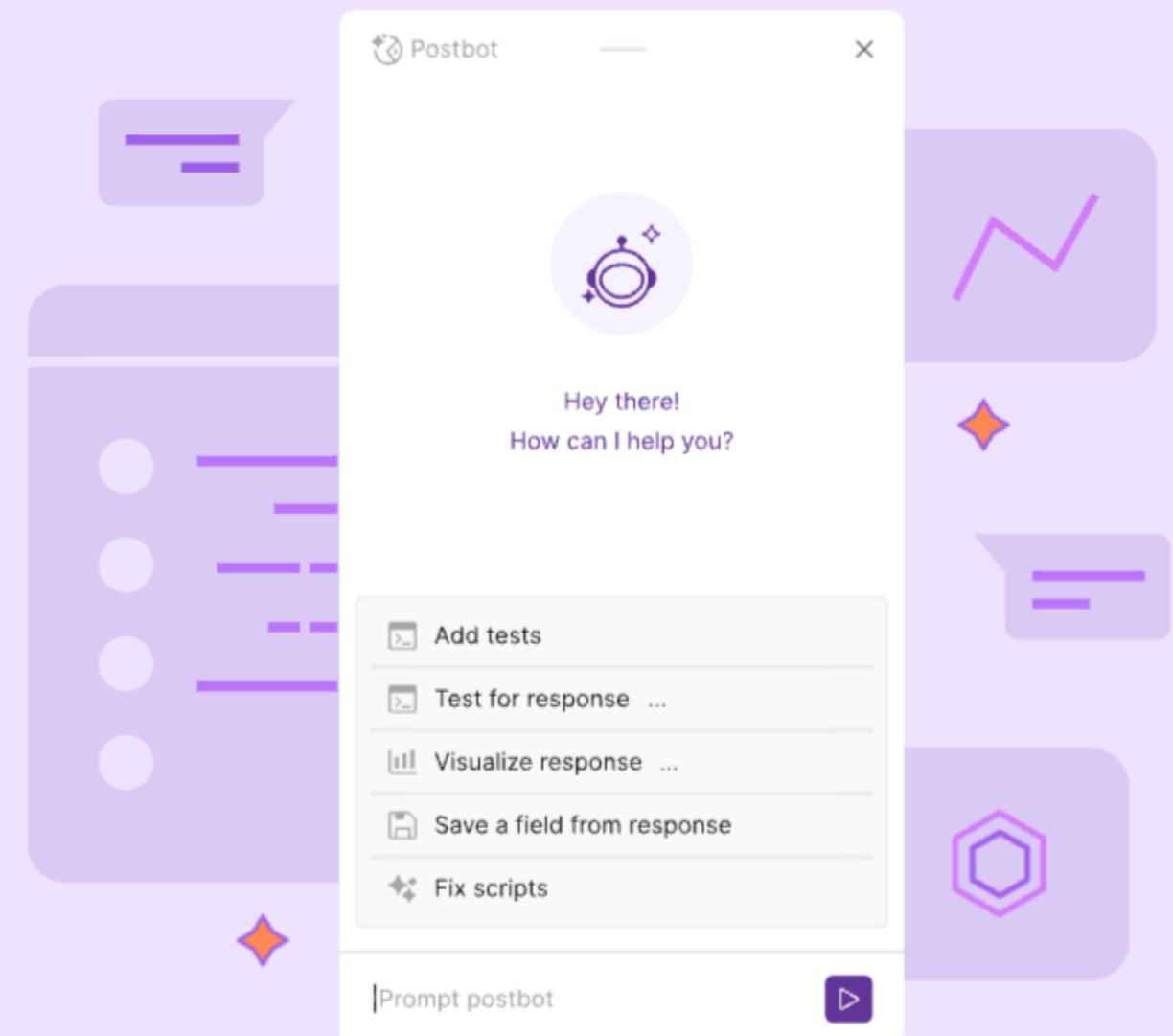


Testing with Postman

Postbot, our AI-powered assistant, will supercharge your API development.

Speed up your most common API development workflows with natural-language input, conversational interactions, and contextual suggestions.

[Get Started](#)



<https://www.postman.com/product/postbot/>



PostBot

The screenshot shows the Postman application interface. At the top, there's a header bar with a save icon, a dropdown menu, and a red pencil icon. Below the header, a modal window titled "Postbot" is displayed, containing a message about auto-complete tests and a list of actions:

- Add tests to this request
- Test for response...
- Visualize response...
- Save a field from response
- Add documentation

At the bottom of the modal, there's a question "Hi! How can I help?" followed by a purple "Ask" button.

The main workspace shows a "New Request" screen for a GET request to <https://jsonplaceholder.typicode.com/users/1>. The "Tests" tab is selected. The response body is displayed in a "Pretty" JSON format:

```
1 {  
2   "id": 1,  
3   "name": "Leanne Graham",  
4   "username": "Bret",  
5   "email": "Sincere@april.biz",  
6   "address": {  
7     "street": "Kulas Light",  
8     "suite": "Apt. 556".  
9   }  
10 }
```

The status bar at the bottom indicates a 200 OK response.

<https://www.postman.com/product/postbot/>



Browser Use

 Browser Use

FEATURES PRICING BLOG DOCUMENTATION

72,343

26.3K

23.5K

CLOUD

[BETA] THE MOST STEALTH BROWSER INFRASTRUCTURE

The AI browser agent

Repetitive work is dead. Browser Use empowers anyone to automate repetitive online tasks, no code required. No barriers. Simply tell it what you want done.

<https://browser-use.com/>



AI for Software Development
© 2020 - 2025 Siam Chamnankit Company Limited. All rights reserved.

128

Playwright Test Agent



<https://playwright.dev/docs/test-agents>



Deployment Process



Deploy and manage

Requirement

Design

Develop

Testing

Deploy

CI/CD pipeline

Infrastructure as a code

Automated script

Performance and monitoring suggestion

Document generation

AI-assist support

ChatOps, AIOps



K8sGPT



**CLOUD NATIVE
SANDBOX** **K8sGPT joins the
CNCF Sandbox**

K8sGPT is a tool for scanning your kubernetes clusters, diagnosing and triaging issues in simple english. It has SRE experience codified into its analyzers and helps to pull out the most relevant information to enrich it with AI.

Get it now!

<https://k8sgpt.ai/>



PromptOps



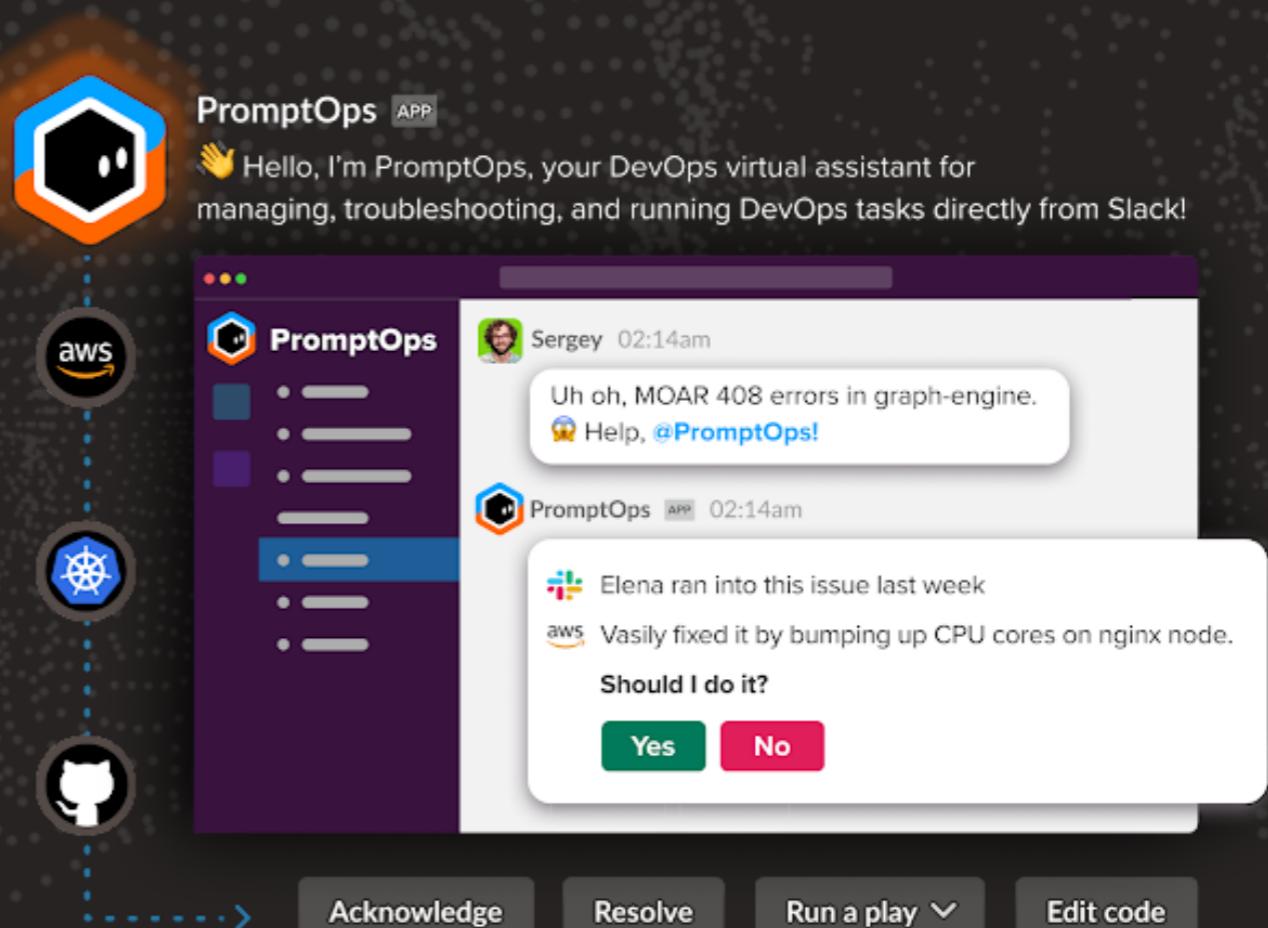
Solutions ▾ Resources ▾ Contact us Log In

ChatGPT for your DevOps Teams

Turn DevOps tasks into automated workflows with a single prompt straight from Slack

Get started

Learn More



<https://www.promptops.com/devops/>



ChatOps for DevOps

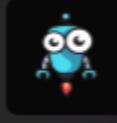
[Product](#)[How it Works](#)[Learn](#)[Company](#)[Uptime](#)[Sign In](#)[Book a demo](#)[Sign Up](#)

> ChatGPT for DevOps

Converse with your engineering platforms, powered by LLM.
A virtual teammate to handle DevOps requests so you can handle the rest.

[Add Kubi to Slack](#)

-  Kubi (DevOps)
@Alerts I got an alert from Prometheus:

Deployment 'alert-manager' on namespace 'Openfaas' is experiencing high traffic
-  Kubi (DevOps)
@Alerts Should I increase the number of replicas on 'alert-manager'?
-  Jeff (R&D)
Yes
-  Kubi (DevOps)

 The following deployment has been updated:
Deployment: alert-manager
Namespace: Openfaas
Replicas: 3

<https://www.kubiya.ai/>



Risks when using Generative AI



Risks

Quality of output generated
Explainability of decisions
Security policy !!
Sensitive data !!



Tips

Understand what you want

Modular approach

Clear and Precise inputs

Make sure you understand the code



Local LLM



Local LLM

Run LLM on local machine/device
Try to customize with your requirement

Reduce cost

Data privacy

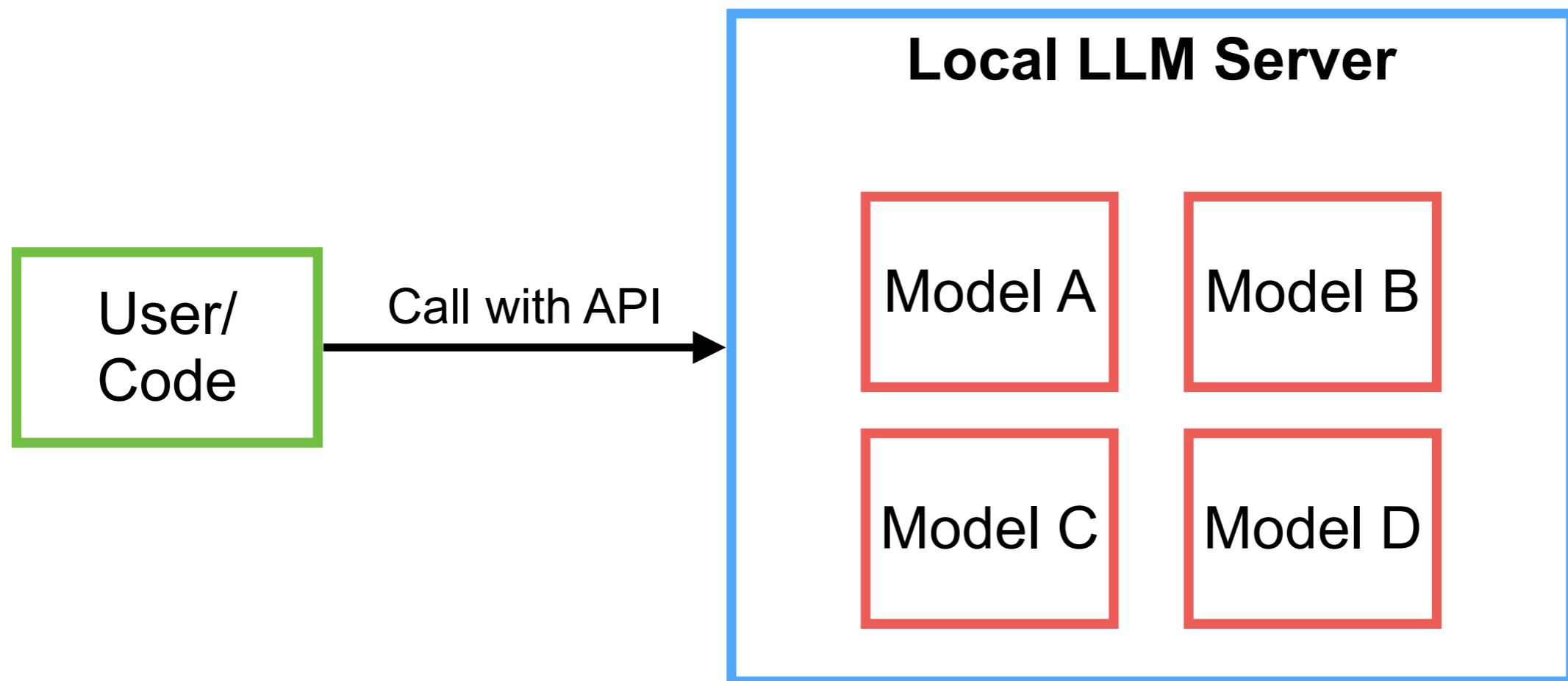
Responsive

Offline mode



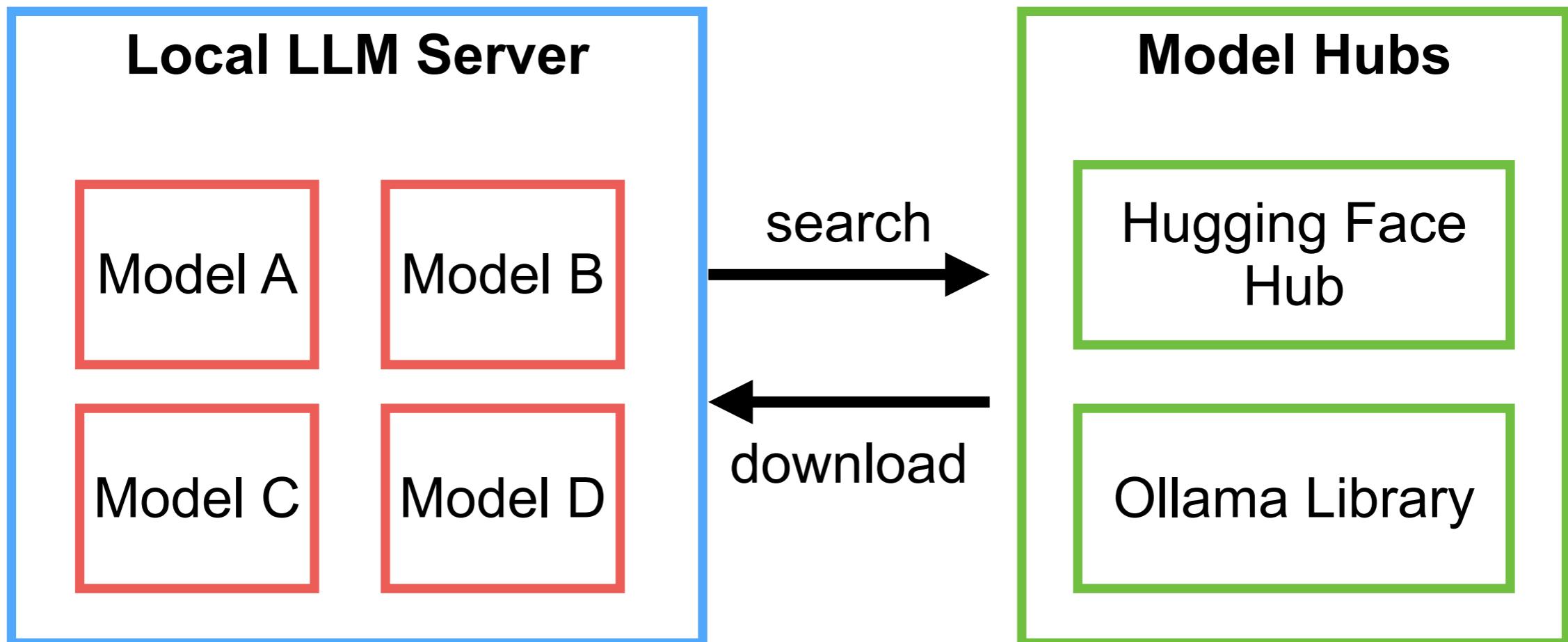
Local LLM

Improve your LLM models, more accurate answer



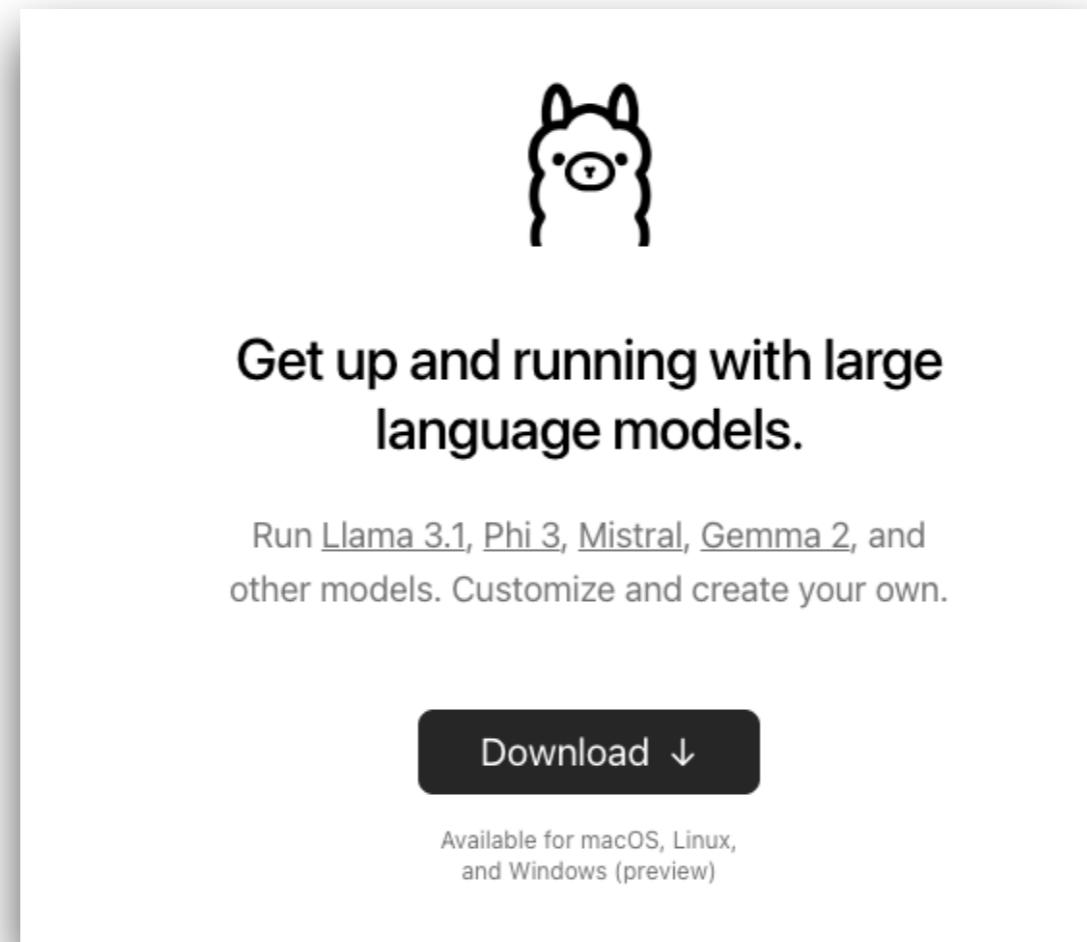
Models ?

How to download models ?



Local LLM with Ollama

\$ollama run **llama3.2**



<https://ollama.com/>



Local LLM with LM Studio

The image shows the LM Studio website and its application interface. The website header includes the LM Studio logo, navigation links for Docs, Blog, and Download, and a download button for v0.3.0. The main content features a hero section with the text "Discover, download, and run local LLMs". It highlights LM Studio v0.3.0 and provides links to run it on various models like LLaMa, Phi, Gemma, DeepSeek, Qwen, and Mistral. It also mentions it's built with open source projects like `llama.cpp` and `lmstudio-js`. Download buttons are provided for Mac (M1/M2/M3), Windows (x64), and Linux (x86). A note states that LM Studio is provided under the [terms of use](#). The application interface shows a code editor with Python code for a snake game, a message input field, a developer console, and various configuration panels for system prompts, general settings, and sampling.

LM Studio

Docs Blog ↗ Download

LM Studio

Discover, download, and run local LLMs

LM Studio v0.3.0 is finally here! 😊😊😊 Read the [announcement](#)

Run [LLaMa](#) [Phi](#) [Gemma](#) [DeepSeek](#) [Qwen](#) [Mistral](#) on your computer ⓘ

Built with open source projects like [llama.cpp](#) and [lmstudio-js](#)

[Download LM Studio for Mac \(M1/M2/M3\) 0.3.2](#)

[Download LM Studio for Windows \(x64\) 0.3.2](#)

[Download LM Studio for Linux \(x86\) 0.3.2](#)

LM Studio is provided under the [terms of use](#)

Advanced Configuration

System Prompt ⓘ Guidelines for the AI Example, "Only answer in rhymes"

General Sampling

Conversation Notes ⓘ Chat Appearance ⓘ

SYSTEM RESOURCES USAGE: RAM: 1.32 GB | CPU: 9.44 %

```
red = (255, 0, 0)
blue = (0, 0, 255)

# Screen dimensions
screen_width = 800
screen_height = 600
screen = pygame.display.set_mode((screen_width, screen_height))
pygame.display.set_caption("Snake Game")

# Clock for controlling frame rate
clock = pygame.time.Clock()

# Snake properties
snake_block_size = 10
snake_speed = 20

# Food properties
food_x = random.randrange(screen_width - snake_block_size, 0)
food_y = random.randrange(screen_height - snake_block_size, 0)

# Font for displaying text
```

Type a message and press Enter to send ...

User (⌘U)

Tokens: 0/8192

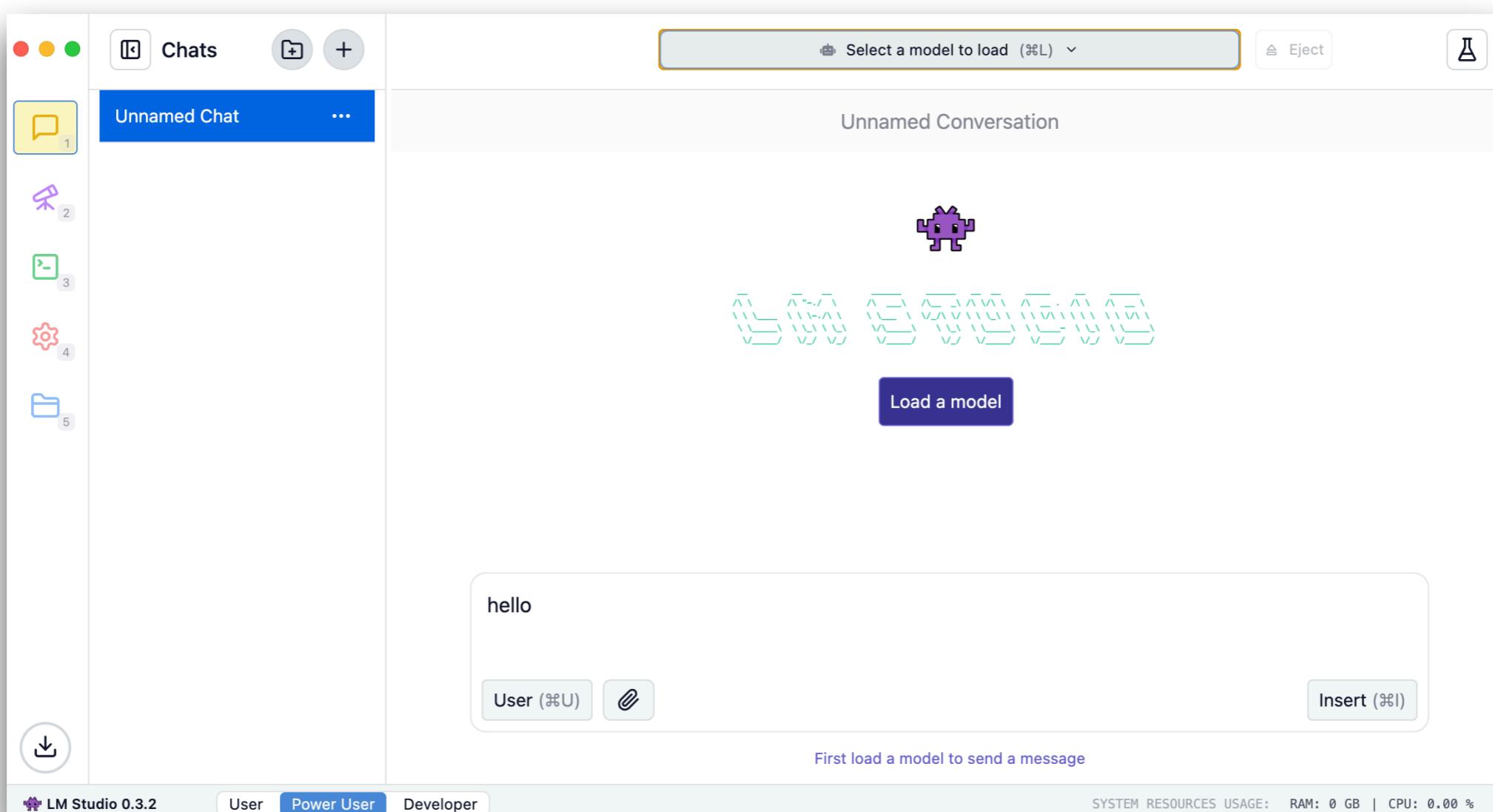
LM Studio 0.3.0 - Beta 3 User Power User Developer

<https://lmstudio.ai/>



Local LLM with LM Studio

Load model from Hugging Face



<https://lmstudio.ai/>



Local LLM with LlamaEdge



LlamaEdge

Feature FAQ Models Docs | [View on GitHub](#)

The easiest, smallest and fastest local LLM runtime and API server.

[Quick Start with Gaia](#)

Powered by Rust & WasmEdge (A CNCF hosted project) [i](#)

<https://llamaedge.com/>



Local LLM with LocalAI



<https://localai.io/>



More

GPT4All

LlamaFile

Jan.ai

NextChat

Anything LLM

<https://github.com/Hannibal046/Awesome-LLM>



LLM Models



Hugging Face Model Hub

NEW AI Tools are now available in HuggingChat

The AI community building the future.

The platform where the machine learning community collaborates on models, datasets, and applications.

Models 469,541

Filter by name

Multimodal

- Text-to-Image
- Image-to-Text
- Text-to-Video
- Visual Question Answering
- Document Question Answering
- Graph Machine Learning

Computer Vision

- Depth Estimation
- Image Classification
- Object Detection
- Image Segmentation
- Image-to-Image
- Unconditional Image Generation
- Video Classification
- Zero-Shot Image Classification

Natural Language Processing

- Text Classification
- Token Classification
- Table Question Answering
- Question Answering
- Zero-Shot Classification
- Translation
- Summarization
- Conversational
- Text Generation
- Text2Text Generation
- Sentence Similarity

Audio

- Text-to-Speech
- Automatic Speech Recognition
- Audio-to-Audio
- Audio Classification
- Voice Activity Detection

Tabular

- Tabular Classification
- Tabular Regression

Reinforcement Learning

- Reinforcement Learning
- Robotics

meta-llama/Llama-2-70b
Text Generation • Updated 4 days ago • 25.2k • 64

stabilityai/stable-diffusion-xl-base-0.9
Updated 6 days ago • 2.01k • 393

openchat/openchat
Text Generation • Updated 2 days ago • 1.3k • 136

llyasviel/ControlNet-v1-1
Updated Apr 26 • 1.87k

cerspense/zeroscope_v2_XL
Updated 3 days ago • 2.66k • 334

meta-llama/Llama-2-13b
Text Generation • Updated 4 days ago • 328 • 64

tiiuae/falcon-40b-instruct
Text Generation • Updated 27 days ago • 288k • 899

WizardLM/WizardCoder-15B-V1.0
Text Generation • Updated 3 days ago • 12.5k • 332

CompVis/stable-diffusion-v1-4
Text-to-Image • Updated about 17 hours ago • 448k • 5.72k

stabilityai/stable-diffusion-2-1
Text-to-Image • Updated about 17 hours ago • 782k • 2.81k

Salesforce/xgen-7b-8k-inst
Text Generation • Updated 4 days ago • 6.18k • 57

<https://huggingface.co/>



Hugging Face :: Model

The screenshot shows the Hugging Face Model Hub interface. On the left, there's a sidebar with categories like 'Tasks', 'Libraries', 'Datasets', 'Languages', 'Licenses', and 'Other'. Below 'Tasks', there are sections for 'Multimodal' (Image-Text-to-Text, Visual Question Answering, Document Question Answering, Video-Text-to-Text, Any-to-Any) and 'Computer Vision' (Depth Estimation, Image Classification, Object Detection, Image Segmentation, Text-to-Image, Image-to-Text, Image-to-Image, Image-to-Video, Unconditional Image Generation, Video Classification, Text-to-Video, Zero-Shot Image Classification, Mask Generation, Zero-Shot Object Detection, Text-to-3D). The main area is a search results page for 'Models' (233,861). A search bar at the top has 'llama' typed into it. To the right of the search bar are 'Full-text search' and 'Sort: Trending' buttons. The results list several models, each with a small icon, the model name, a brief description, and metrics like size, updates, and popularity (stars).

Model	Description	Size	Last Update	Popularity
black-forest-labs/FLUX.1-dev	Text-to-Image	919k	Aug 16	4.73k
meta-llama/Meta-Llama-3.1-8B-Instruct	Text Generation	3.09M	Aug 21	2.61k
jinaai/reader-lm-1.5b	Text Generation	8.28k	5 days ago	382
black-forest-labs/FLUX.1-schnell	Text-to-Image	1.06M	Aug 16	2.36k
nvidia/Llama-3_1-Nemotron-51B-Instruct	Text Generation	61	about 14 hours ago	79
dleemiller/word-llama-12-supercat			Aug 12	81
ICTNLP/Llama-3.1-8B-Omni			12 days ago	324

<https://huggingface.co/>



Big Code model leader board

 Big Code Models Leaderboard

Inspired from the 😊 Open LLM Leaderboard and 😊 Open LLM-Perf Leaderboard 🚀, we compare performance of base multilingual code generation models on [HumanEval](#) benchmark and [MultiPL-E](#). We also measure throughput and provide information about the models. We only compare open pre-trained multilingual code models, that people can start from as base models for their trainings.

 Evaluation table  Performance Plot  About [Submit results](#) 

[See All Columns](#) ◀

 Search for your model and press ENTER...

Filter model types

all  base  instruction-tuned  EXT external-evaluation

T	Model	Win Rate	humaneval-python	java	javascript	cpp
◆ EXT	OpenCodeInterpreter-DS-33B	55.83	75.23	54.8	69.06	64.47
◆ EXT	Nxcode-C0-7B-orpo	55.42	87.23	60.91	71.69	68.04
◆	CodeOwen1.5-7B-Chat	55.08	87.2	61.04	70.31	67.85
◆ EXT	CodeFuse-DeepSeek-33b	54.33	76.83	60.76	66.46	65.22
◆ EXT	DeepSeek-Coder-33b-instruct	52	80.02	52.03	65.13	62.36
◆ EXT	Artigenz-Coder-DS-6.7B	51.5	70.89	56.84	66.16	59.75
◆ EXT	DeepSeek-Coder-7b-instruct	50.33	80.22	53.34	65.8	59.66
◆ EXT	OpenCodeInterpreter-DS-6.7B	49.67	73.2	51.41	63.85	60.01

<https://huggingface.co/spaces/bigcode/bigcode-models-leaderboard>



Model in Ollama

The screenshot shows the Ollama library interface. At the top left is a circular icon of a cartoon llama. To its right, the word "Models" is displayed. Below this is a search bar containing the text "deepseek". To the right of the search bar is a dropdown menu set to "Featured".

deepseek-coder-v2
An open-source Mixture-of-Experts code language model that achieves performance comparable to GPT4-Turbo in code-specific tasks.

Code 16B 236B
↓ 307K Pulls 65 Tags Updated 3 months ago

deepseek-coder
DeepSeek Coder is a capable coding model trained on two trillion code and natural language tokens.

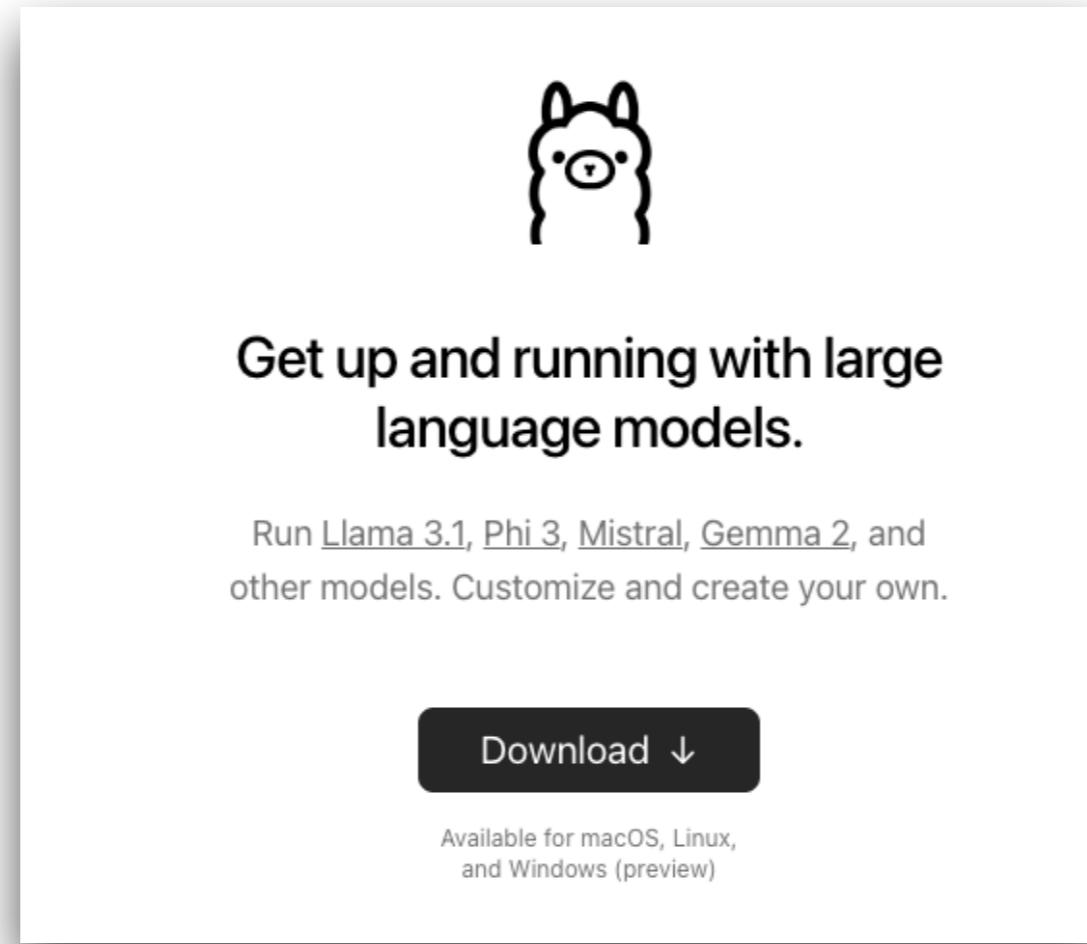
Code 1B 7B 33B
↓ 303.9K Pulls 102 Tags Updated 9 months ago

<https://ollama.com/library>



Workshop with Ollama

\$ollama run **llama3.1**



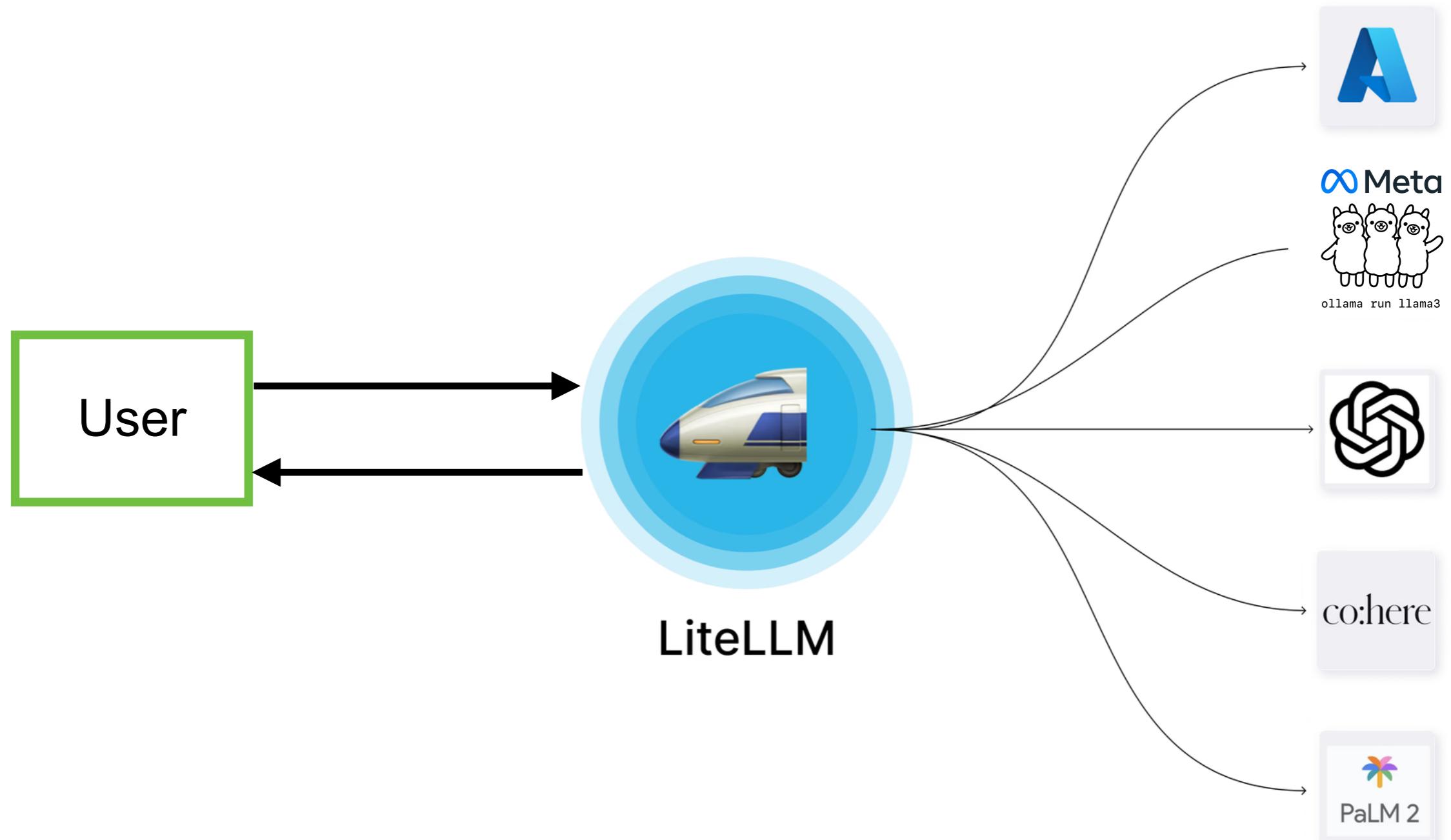
<https://github.com/up1/workshop-ai-with-technical-team/wiki/Local-LLM-with-Ollama>



LiteLLM as a Proxy



LiteLLM as a Proxy

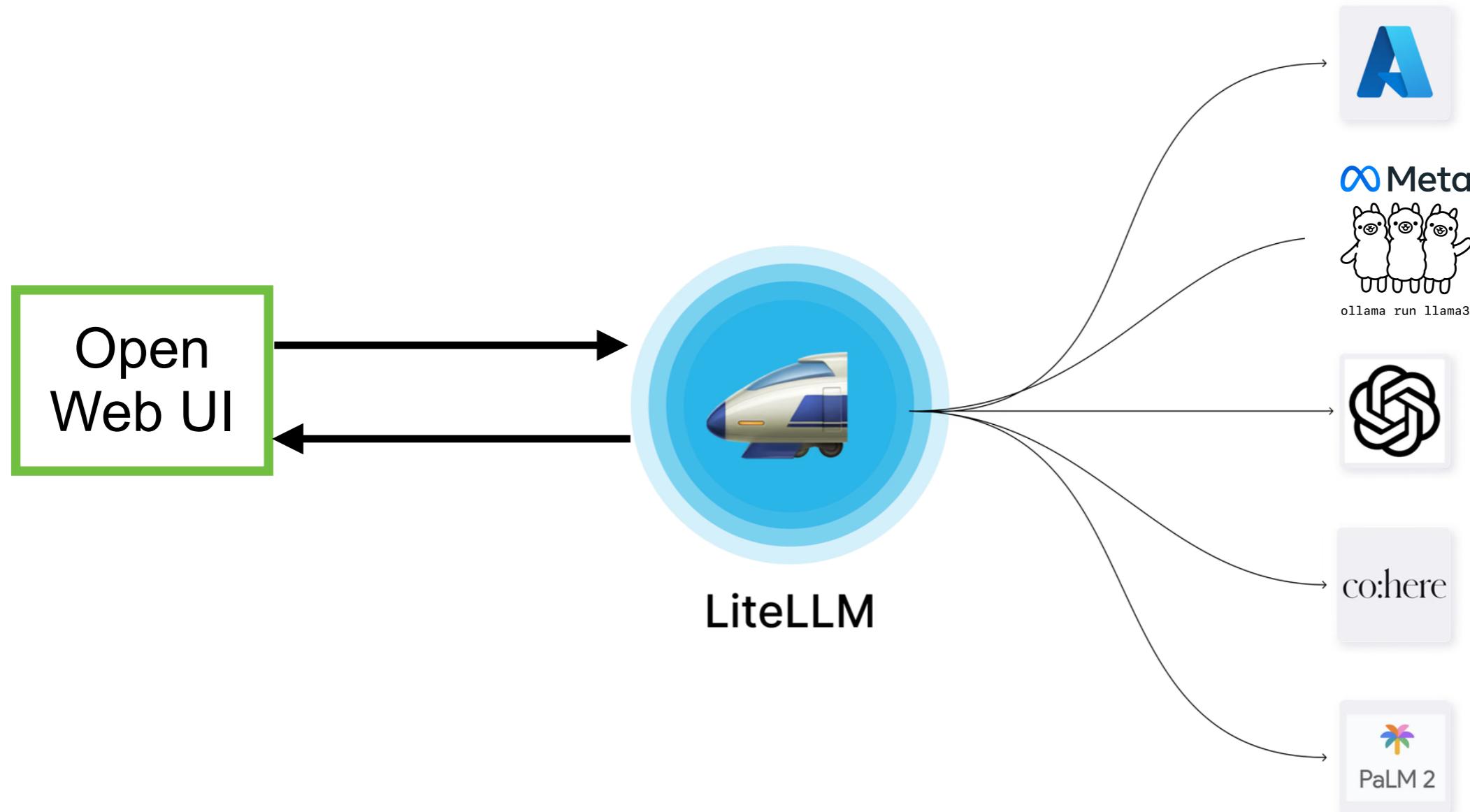


<https://www.litellm.ai/>



Workshop

Use docker compose to build and run



<https://github.com/up1/workshop-ai-with-technical-team/wiki/LiteLLM-and-WebUI>

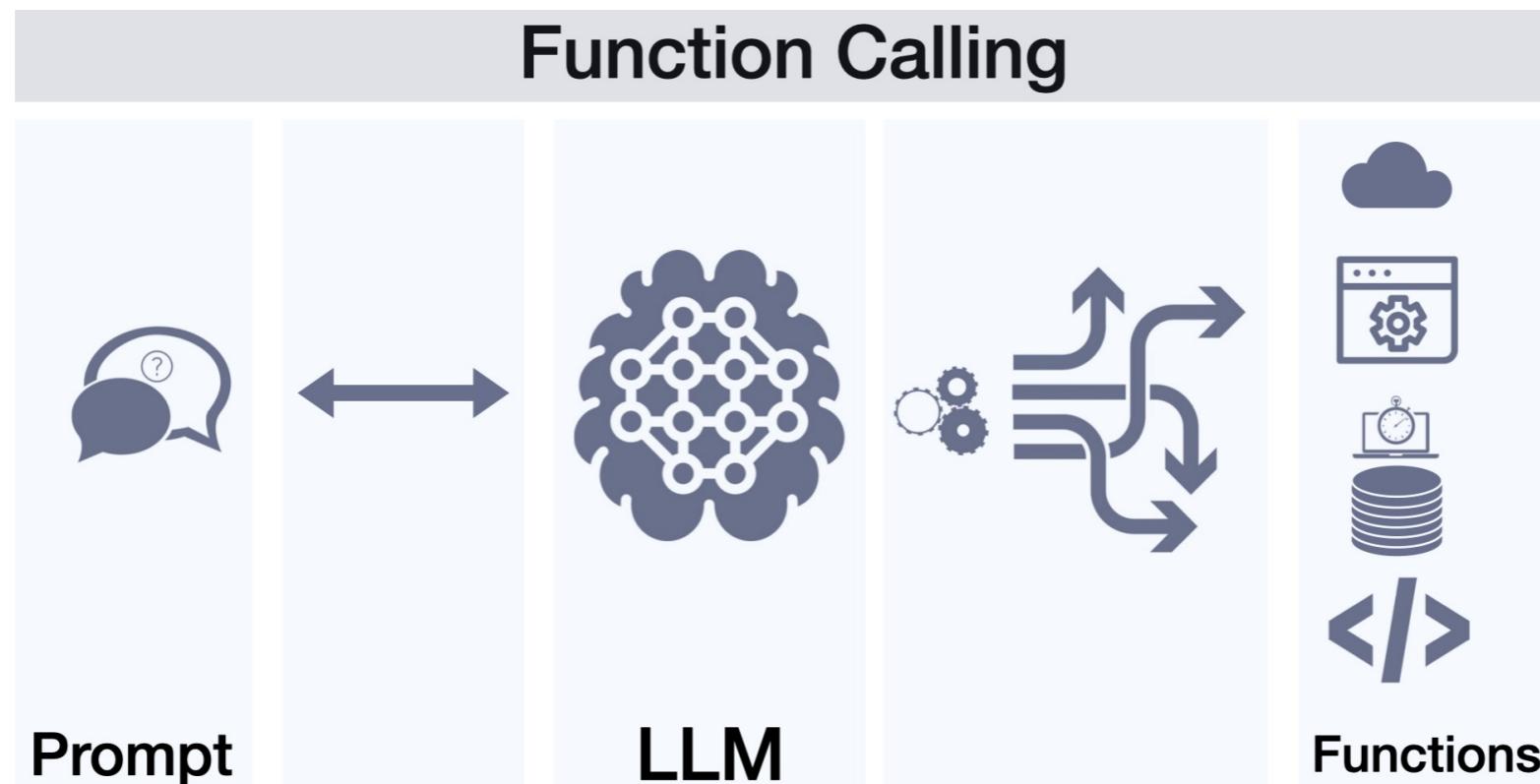


Function Calling ?

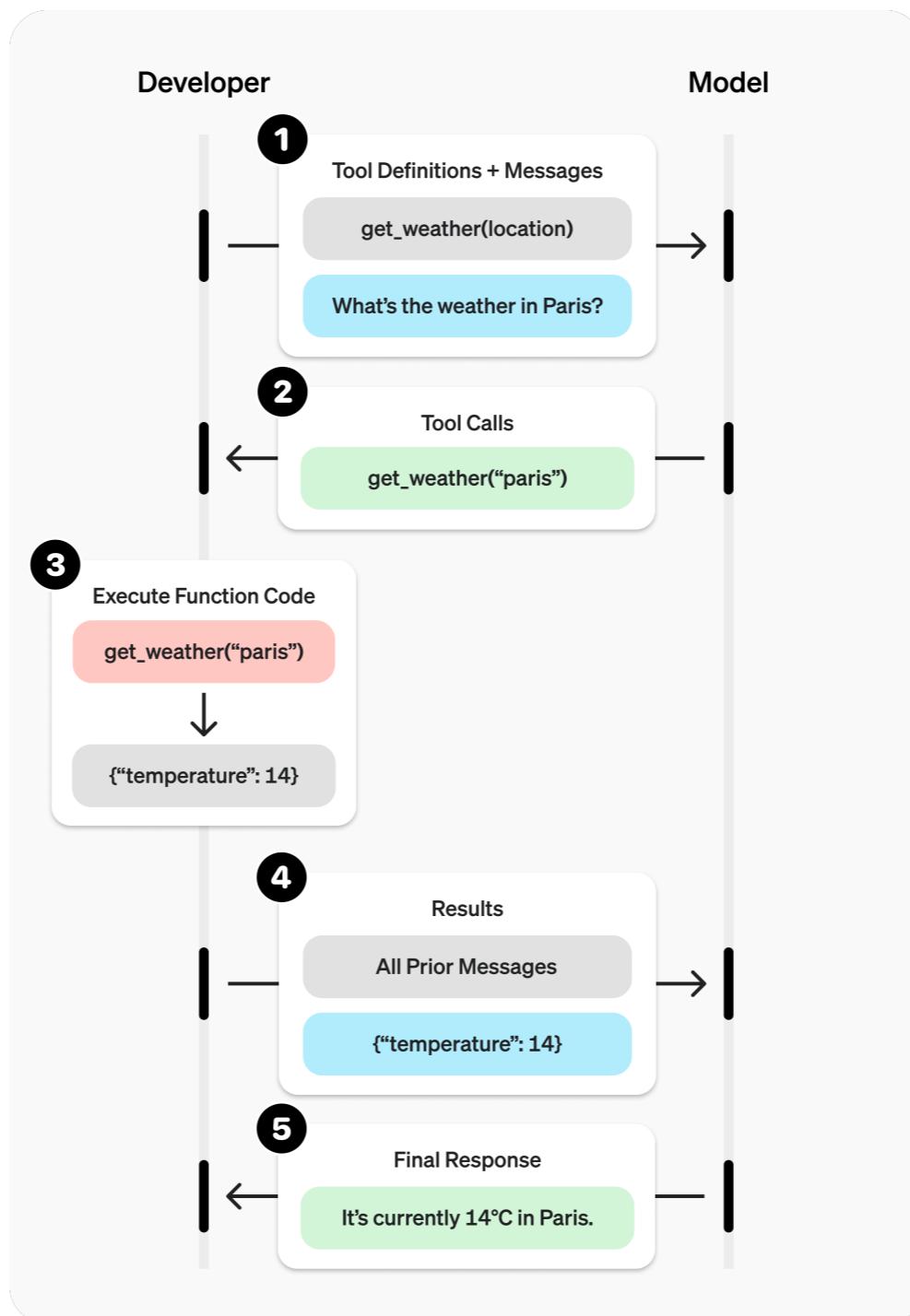


Function Calling ?

Allow LLM to recognize what tool it need based on user's input and when to invoke it.



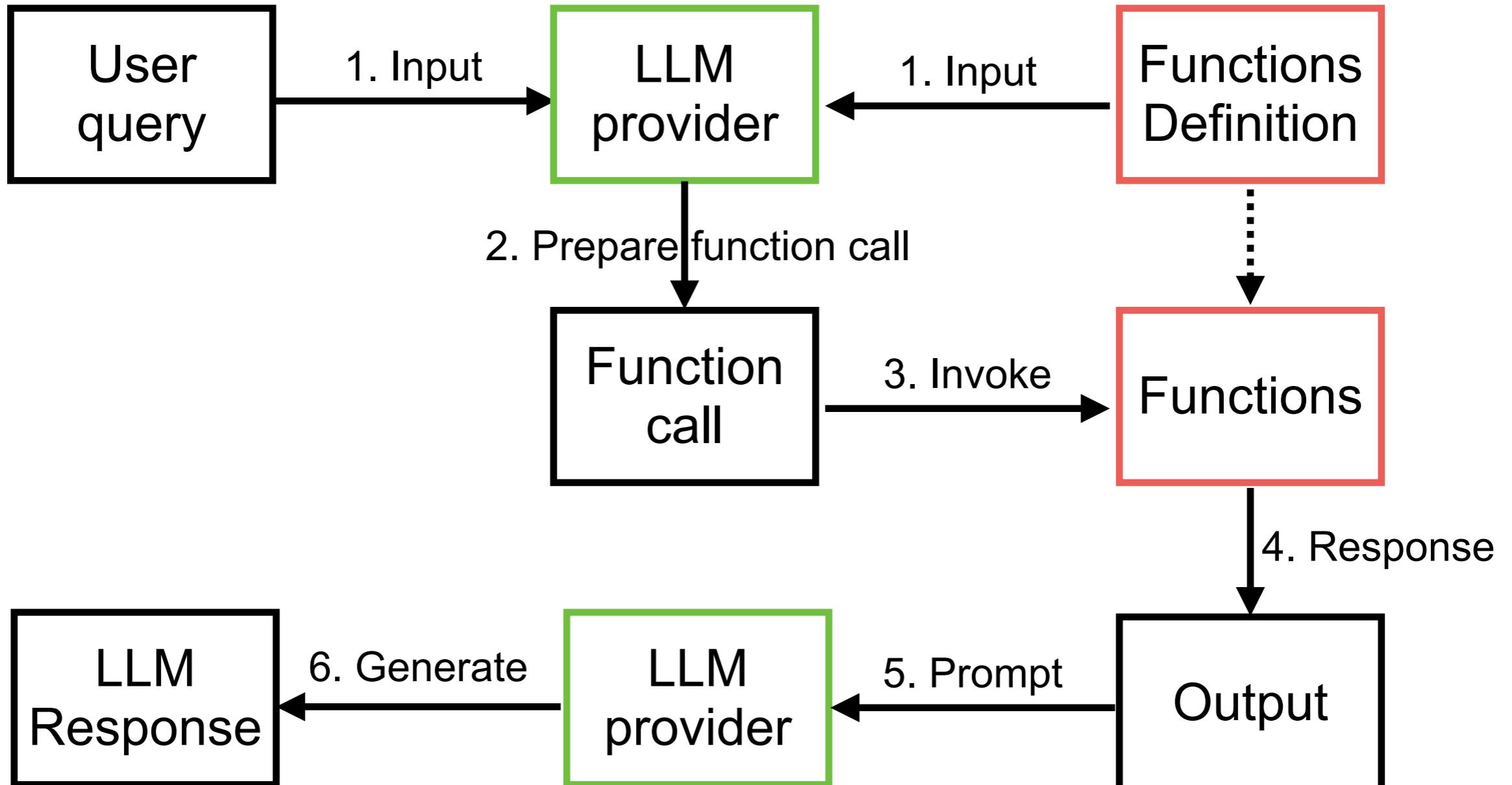
Function calling ?



<https://platform.openai.com/docs/guides/function-calling?api-mode=responses>



Function Calling



Support function calling

Provider name	Model name
OpenAI	GPT 4
Anthropic	Claude 3 (Sonnet, Haiku, Opus)
Google	Gemini



Function calling !!

APIs: Every tool needs its own key

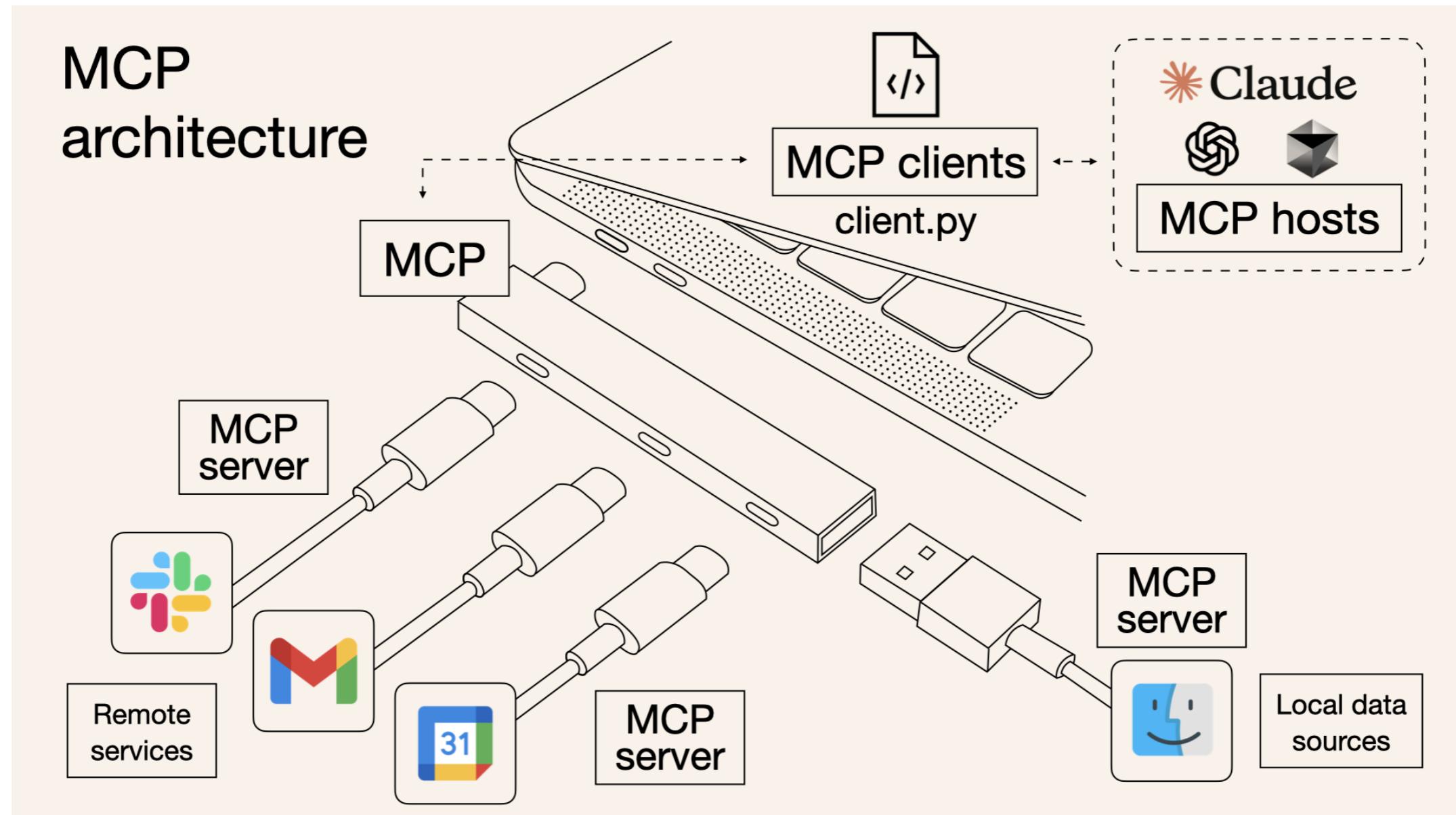
Traditional APIs require different authentication and integration for each service,
like needing different keys for different locks

APIs

<https://norahsakal.com/blog/mcp-vs-api-model-context-protocol-explained/>



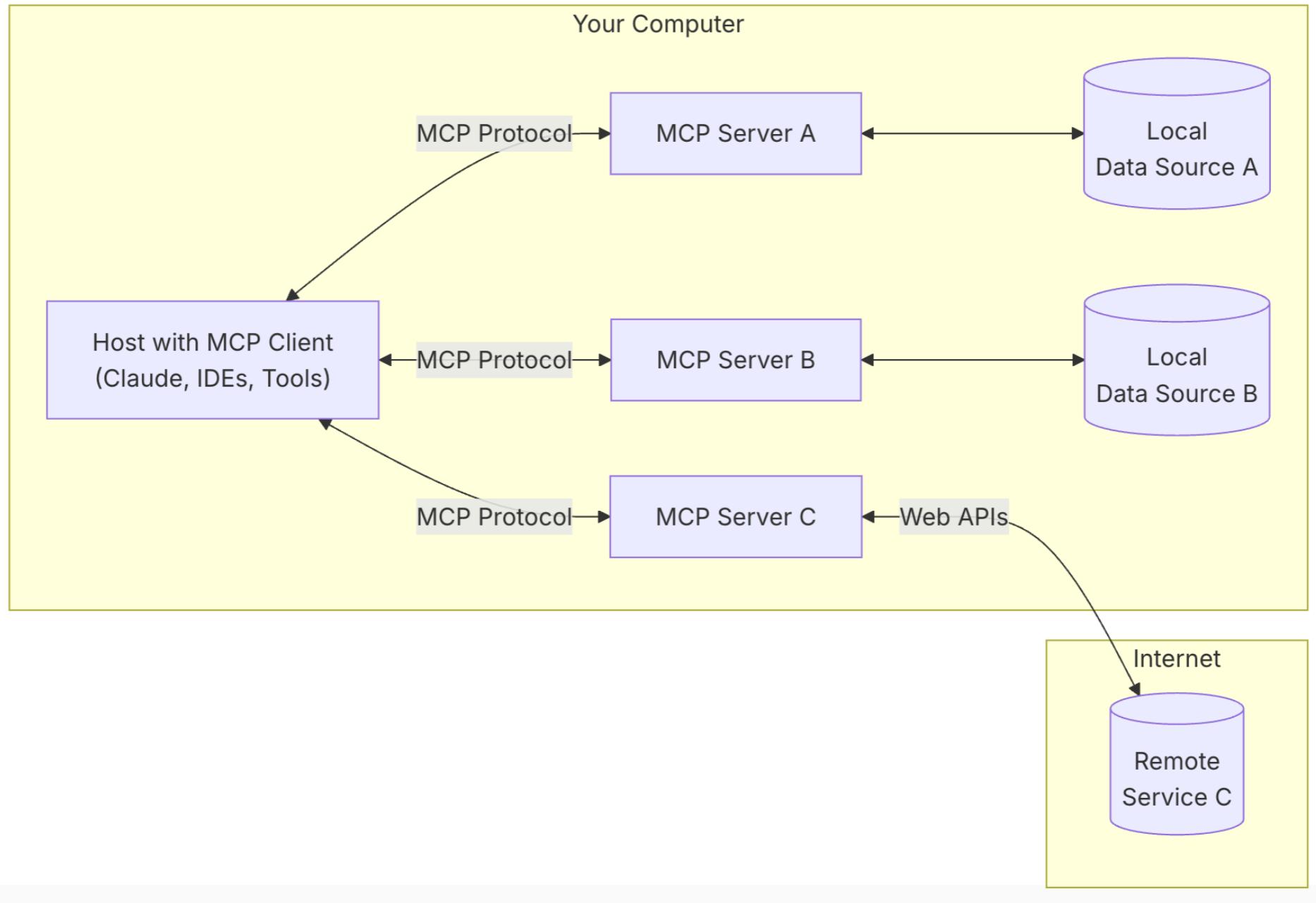
Standardized function calling !!



<https://norahsakal.com/blog/mcp-vs-api-model-context-protocol-explained/>



Model Context Protocol



<https://modelcontextprotocol.io/>



Retrieval-Augmented Generation (RAG)



RAG

Enhances LLMs by retrieving external knowledge before generating response

Improve accuracy

Reduce hallucinations

Real-time knowledge updates



Core Components

Retriever

Fetch relevant documents from a knowledge base

Generator

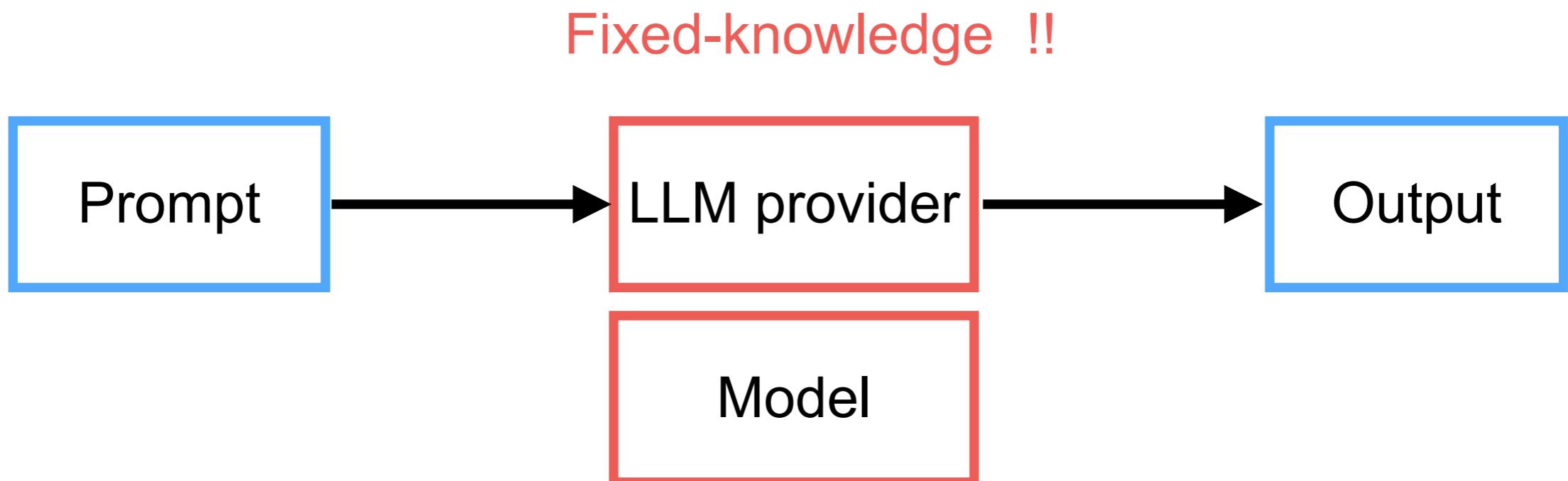
Uses the retrieved information to generate a response

Enhancements

Different RAG architectures modify how retrieval and generation interact to improve performance

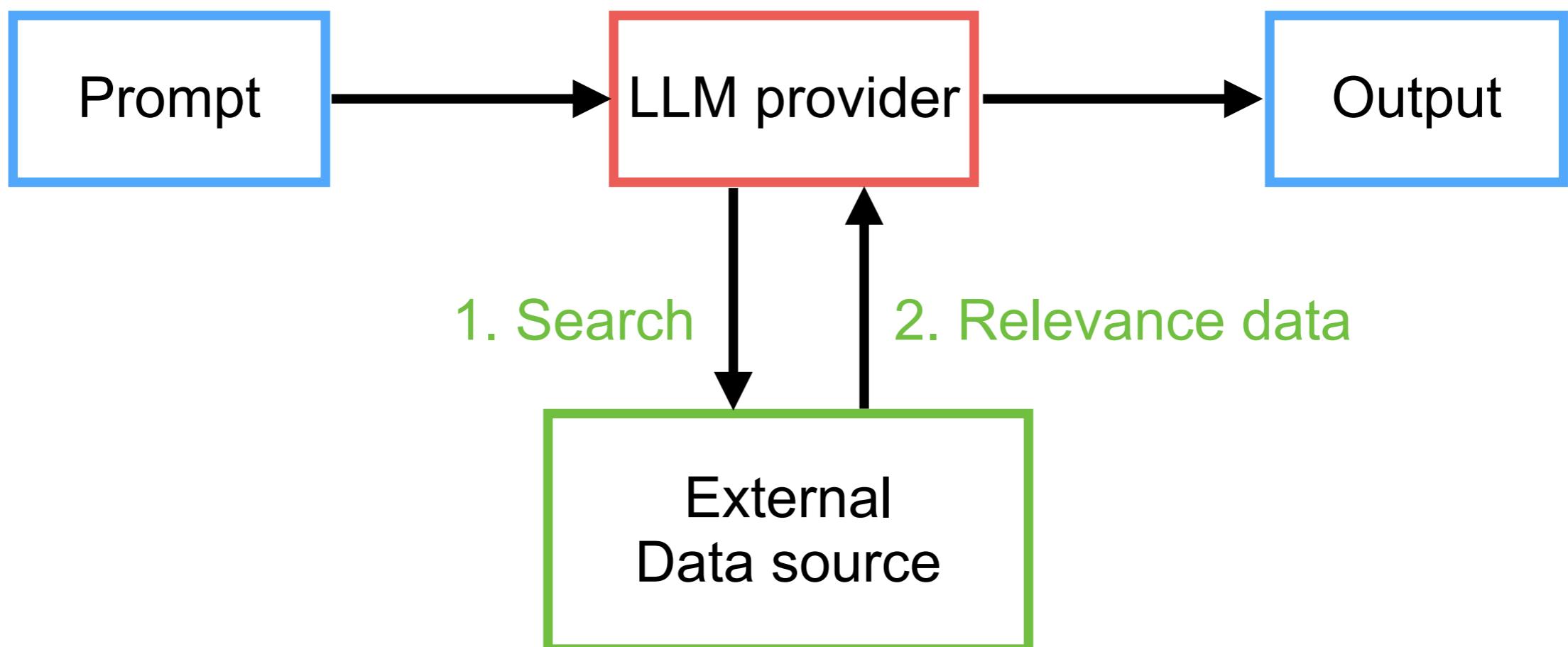


Limitation of LLM



RAG ?

Fixed-knowledge !!



How to search/retrieve data ?

Data source

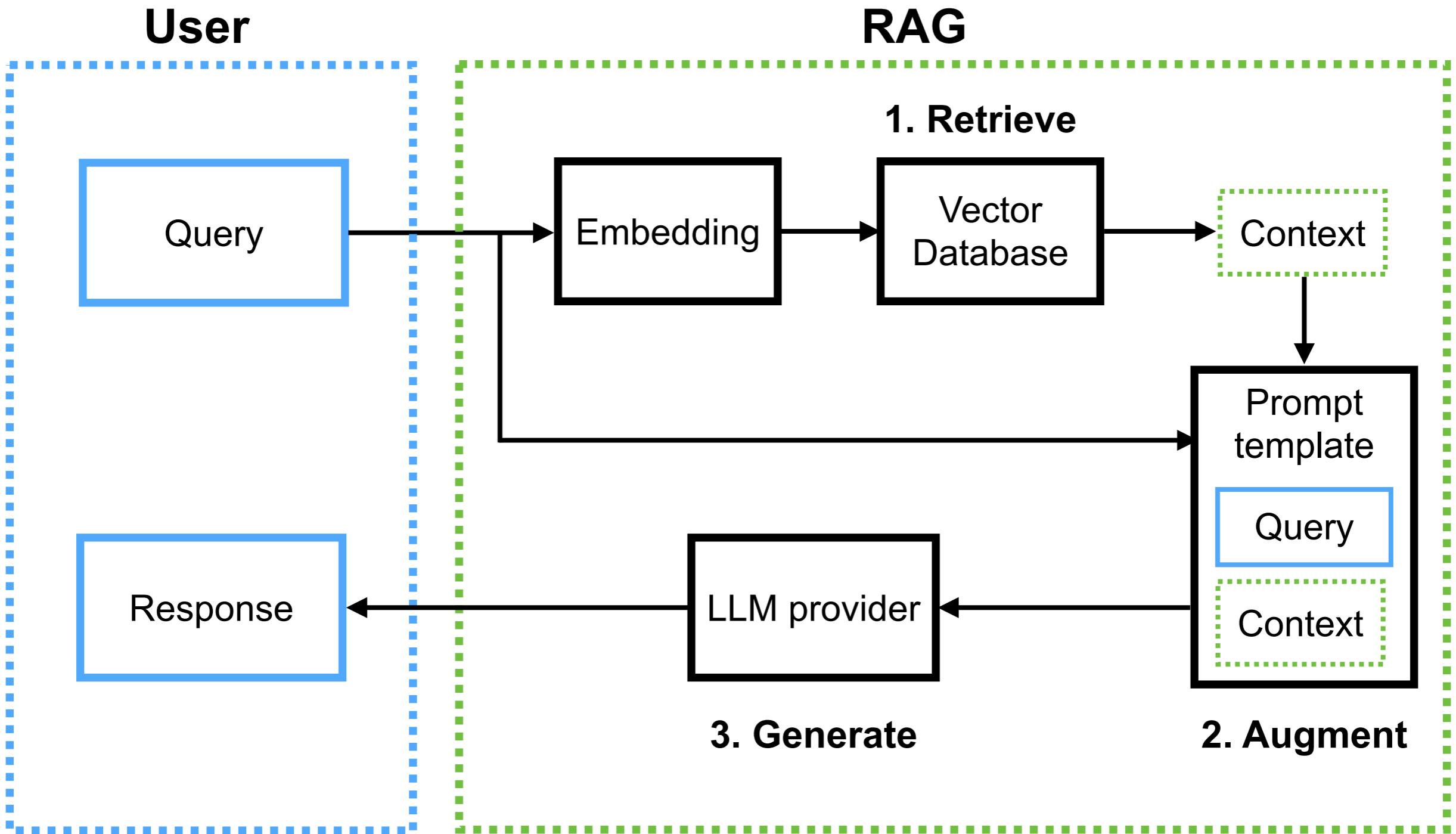
Data preparation

Search

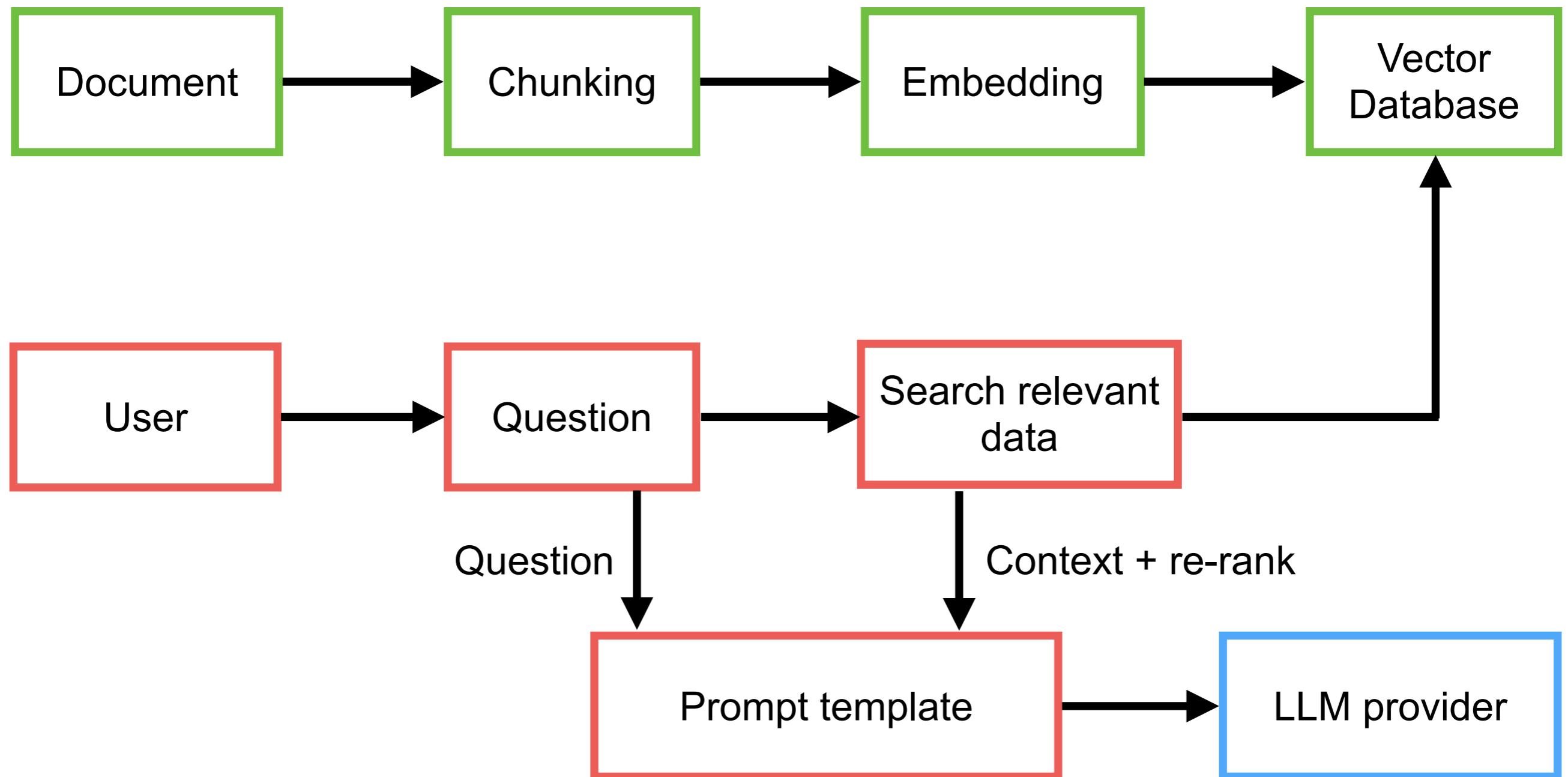
Search result



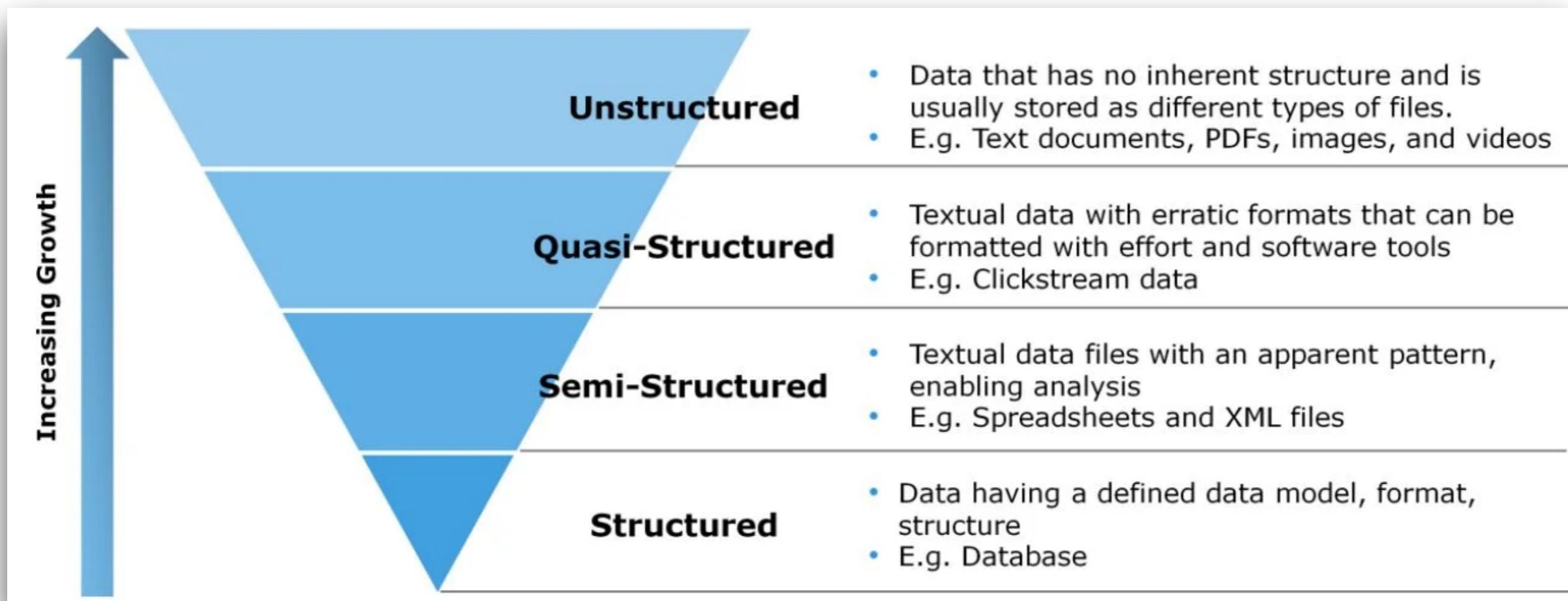
Basic RAG Architecture



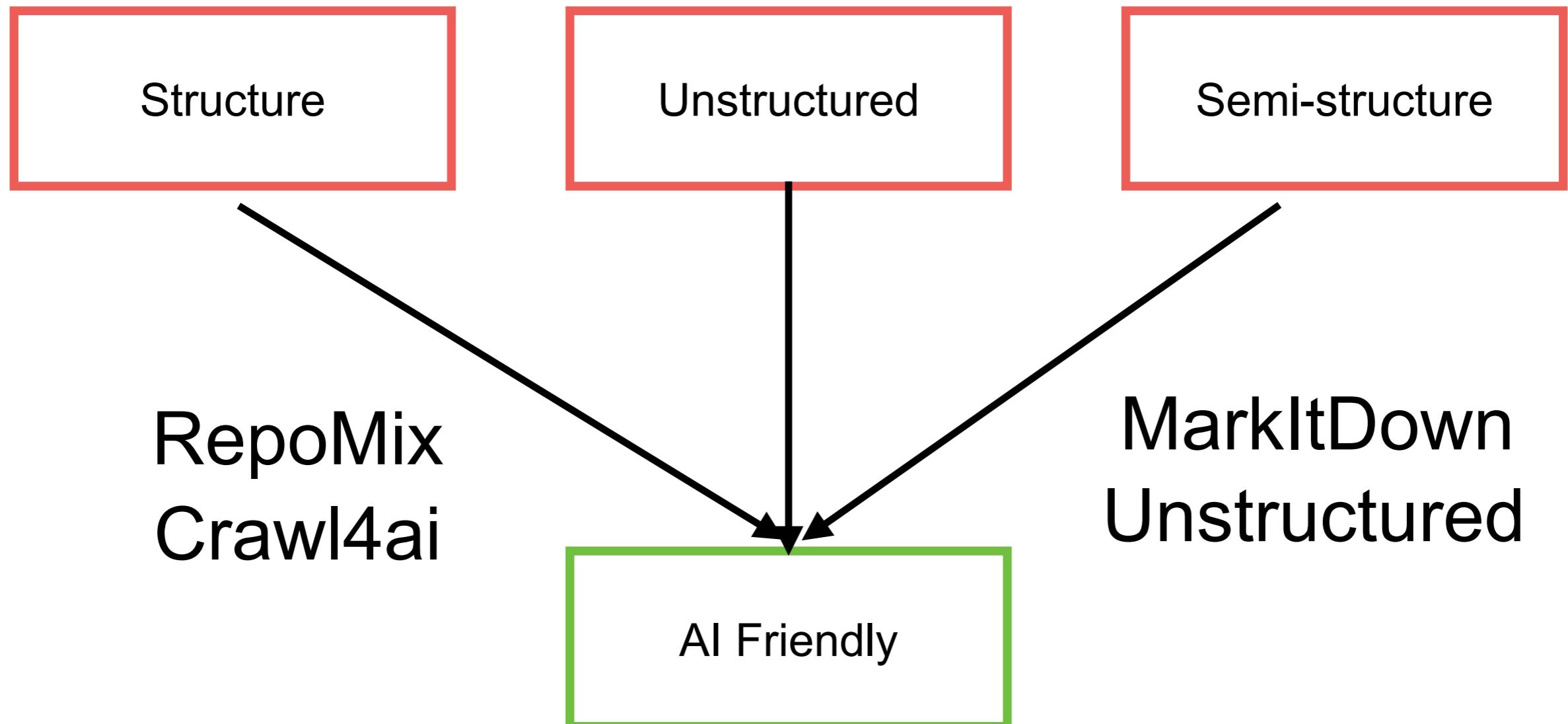
RAG process



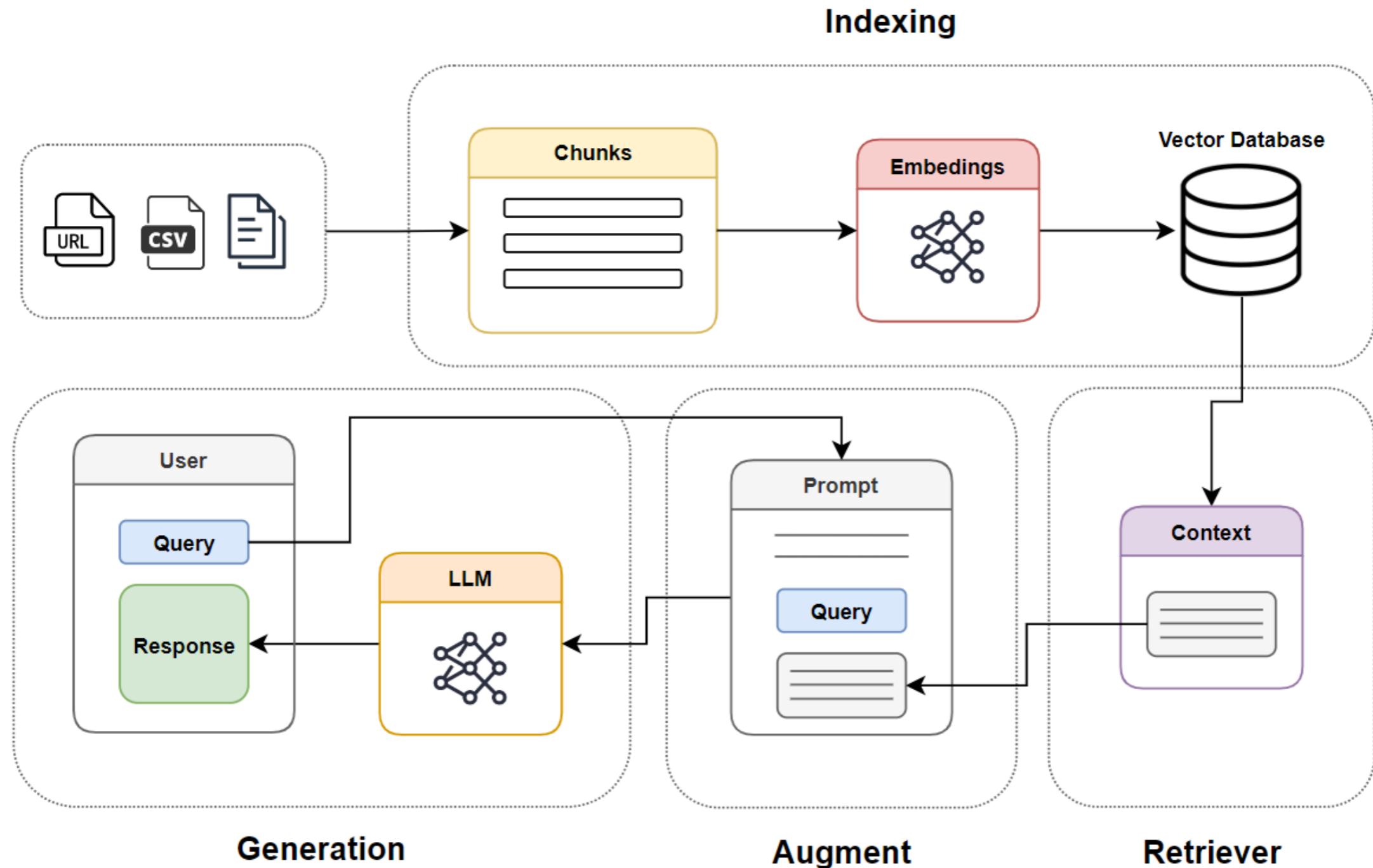
Structures of Data ?



Friendly Data for LLM/AI



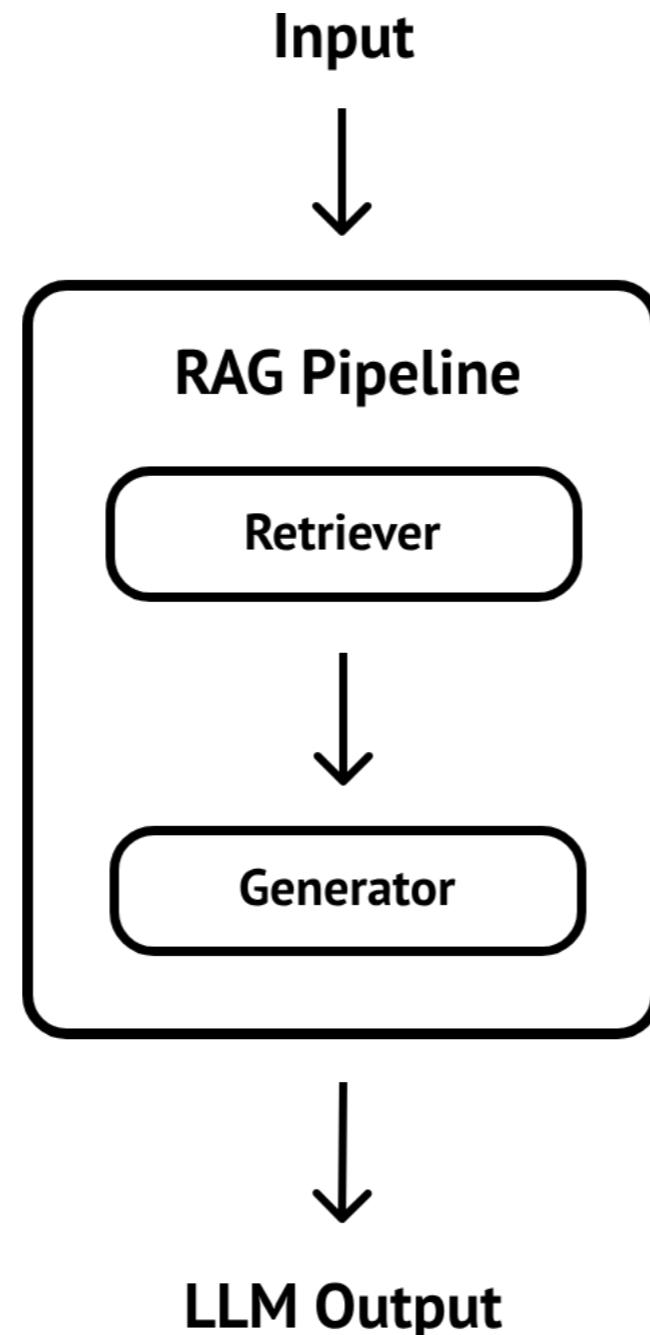
RAG Cookbook (techniques)



<https://github.com/athina-ai/rag-cookbooks>



RAG Evaluation !!



Retriever Metrics:

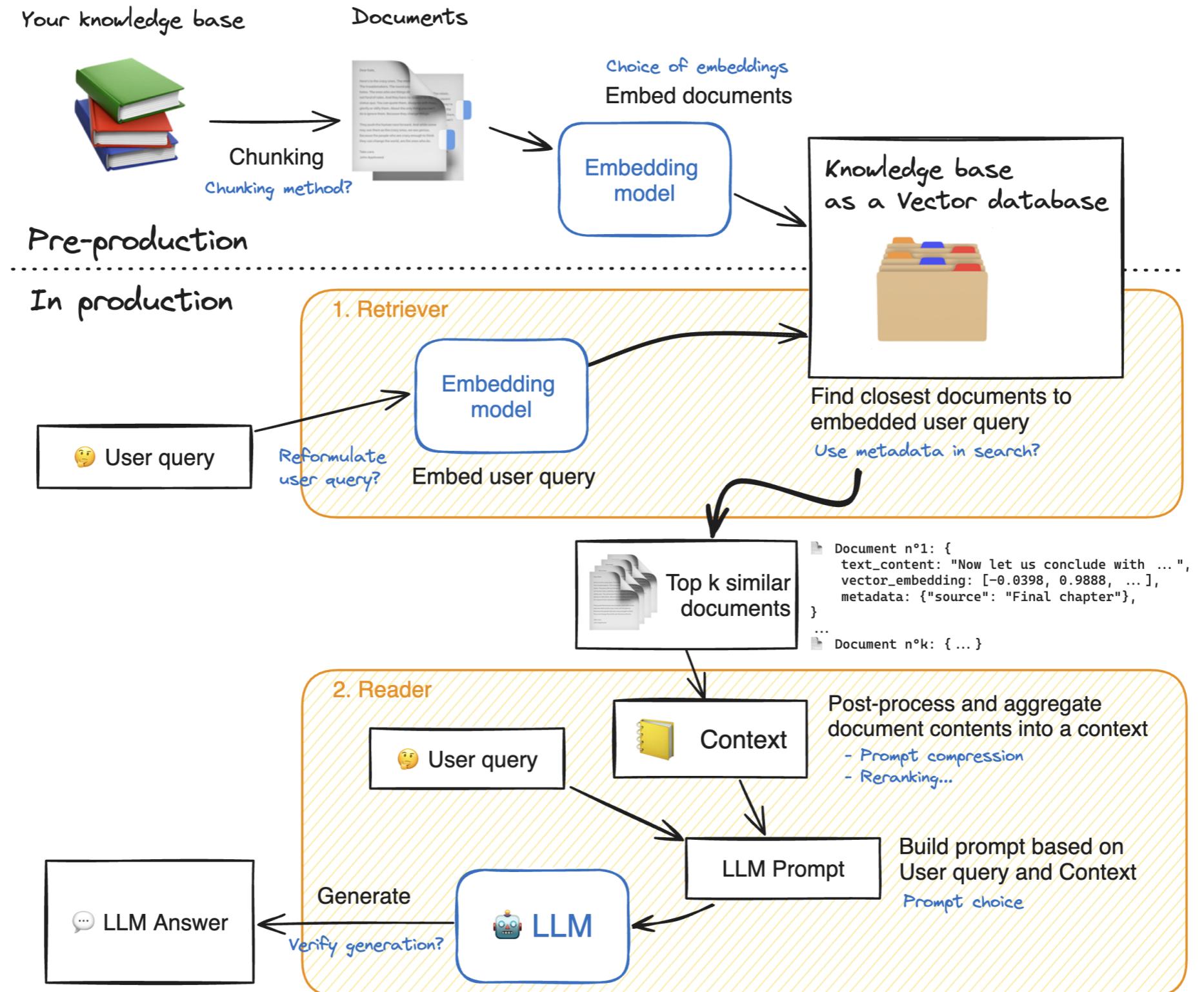
- Contextual Recall
- Contextual Precision
- Contextual Relevancy

Generator Metrics:

- Answer Relevancy
- Faithfulness

<https://www.deepeval.com/guides/guides-rag-evaluation>

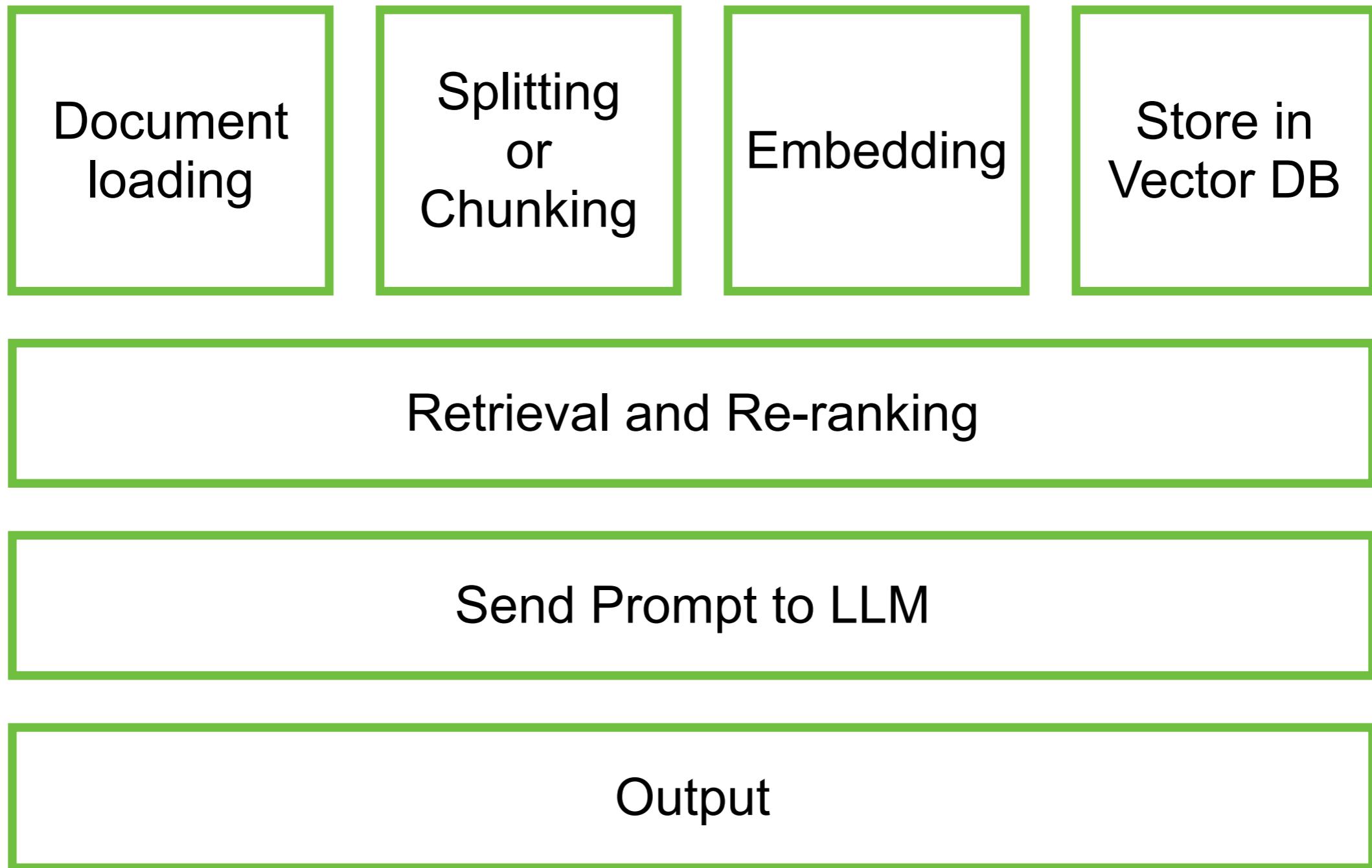




https://huggingface.co/learn/cookbook/en/rag_evaluation



RAG Implementation



Failure Points of RAG

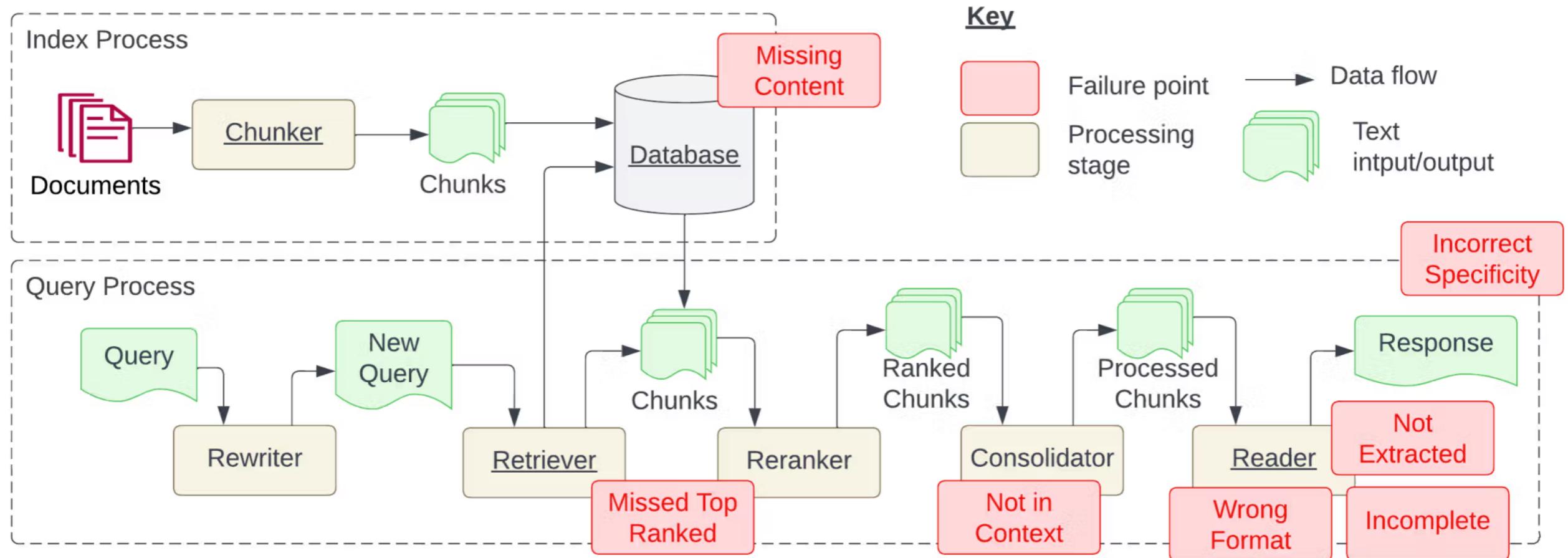


Figure 1: Indexing and Query processes required for creating a Retrieval Augmented Generation (RAG) system. The indexing process is typically done at development time and queries at runtime. Failure points identified in this study are shown in red boxes. All required stages are underlined. Figure expanded from [19].

<https://www.galileo.ai/blog/mastering-rag-how-to-architect-an-enterprise-rag-system>



RAG is better

But come with Cost !!

More latency

Retrieval errors

Accuracy !!

More
Complexity

Maintenance
overhead



RAG Techniques ?

Semantic
chunking

Chunk size
selector

Context chunk
header

Adaptive RAG

Re-ranking

Graph TAG

<https://github.com/FareedKhan-dev/all-rag-techniques>



Pre-Retrieval optimization ?

Preprocessing and cleansing data

Chunking strategies

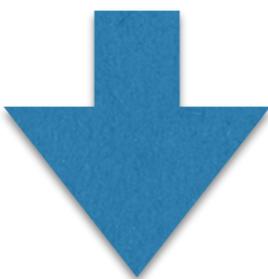
Add metadata

Embedding model selection

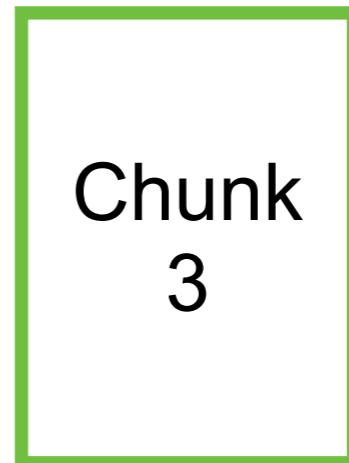
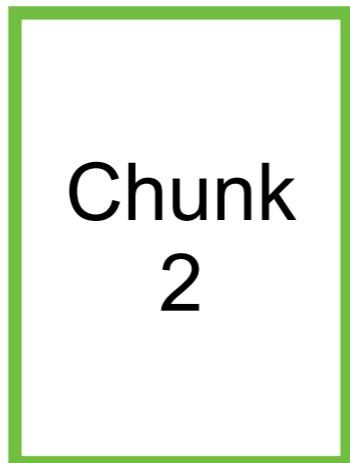


Chunking strategies

Size of Document
> context window size

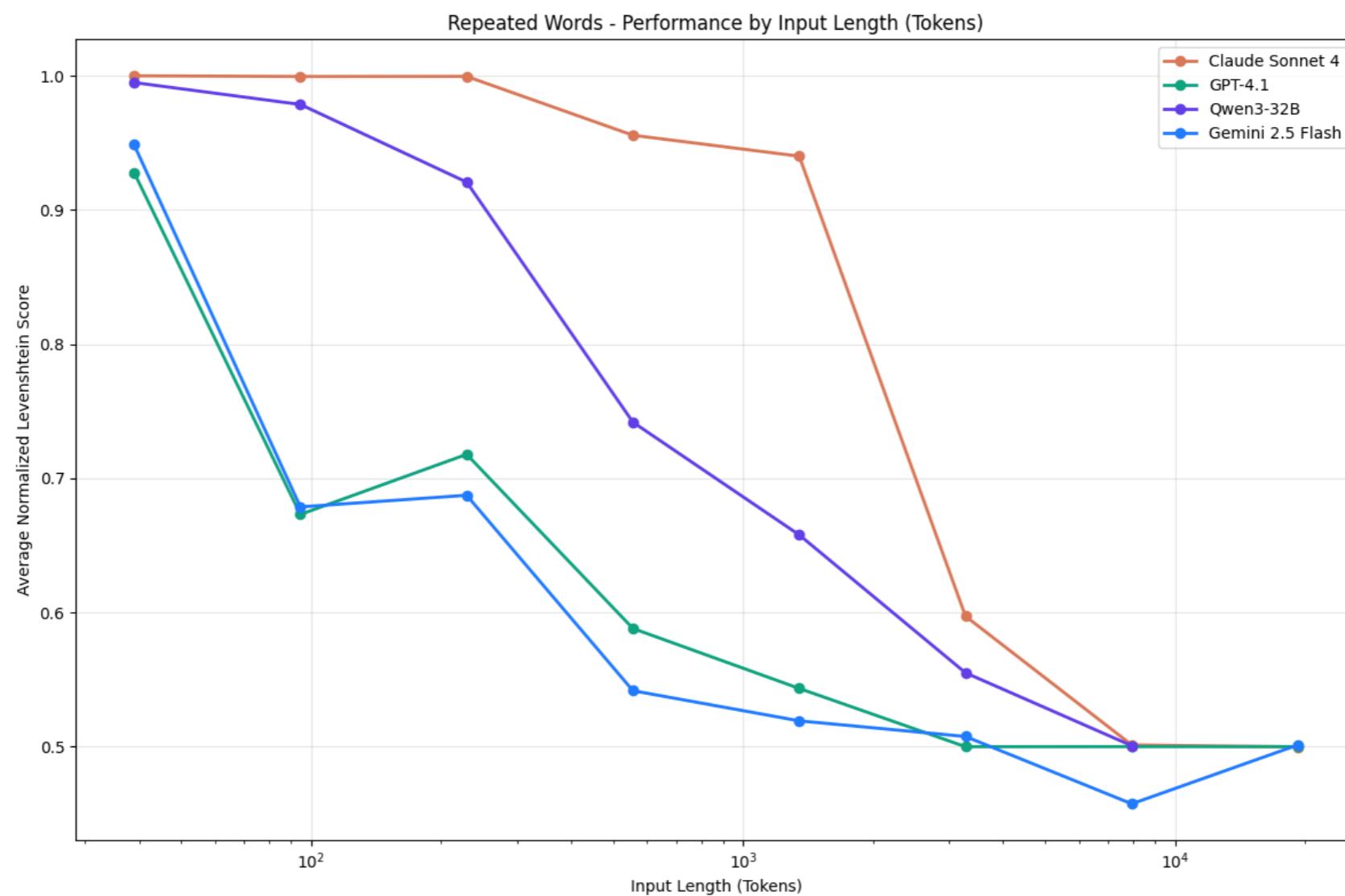


Chunking



Context Window ?

Number of tokens in the context window increases,
the model's ability to accurately recall information from that context decreases



<https://www.anthropic.com/engineering/effective-context-engineering-for-ai-agents>



Chunking Strategies !!

Fixed size
Recursive characters
Document structure-based
Semantic chunking
Agentic chunking

...

<https://blog.dailydoseofds.com/p/5-chunking-strategies-for-rag>



Good Chunking

Efficiency

Relevance

Context
preservation

Improve content
generation

Reduce noise



Bad Chunking

Loss context

Redundancy

Inconsistency



Chunking Visualization

ChunkViz v0.1

Want to learn more about AI Engineering Patterns? Join me on [Twitter](#) or [Newsletter](#).

Language Models do better when they're focused.

One strategy is to pass a relevant subset (chunk) of your full data. There are many ways to chunk text.

This is a tool to understand different chunking/splitting strategies.

[Explain like I'm 5...](#)

One of the most important things I didn't understand about the world when I was a child is the degree to which the returns for performance are superlinear.

Teachers and coaches implicitly told us the returns were linear. "You get out," I heard a thousand times, "what you put in." They meant well, but this is rarely true. If your product is only half as good as your competitor's, you don't get half as many customers. You get no customers, and you go out of business.

It's obviously true that the returns for performance are superlinear in business. Some think this is a flaw of capitalism, and that if we changed the rules it would stop being true. But superlinear returns for performance are a feature of the world, not an artifact of rules we've invented. We see the same pattern in fame, power, military victories, knowledge, and

[Upload .txt](#)

Splitter: 

Chunk Size:

Chunk Overlap:

Total Characters: 2658
Number of chunks: 107
Average chunk size: 24.8

One of the most important things I didn't understand about the world when I was a child is the degree to which the returns for performance are superlinear.

Teachers and coaches implicitly told us the returns were linear. "You get out," I heard a thousand times, "what you put in." They meant well, but this is rarely true. If your product is only half as good as your competitor's, you don't get half as many customers. You get no customers, and you go out of business.

<https://chunkviz.up.railway.app/>



Retrieval optimization ?

Re-ranking

Hybrid search

Query
transformation

Multi-vector
embedding

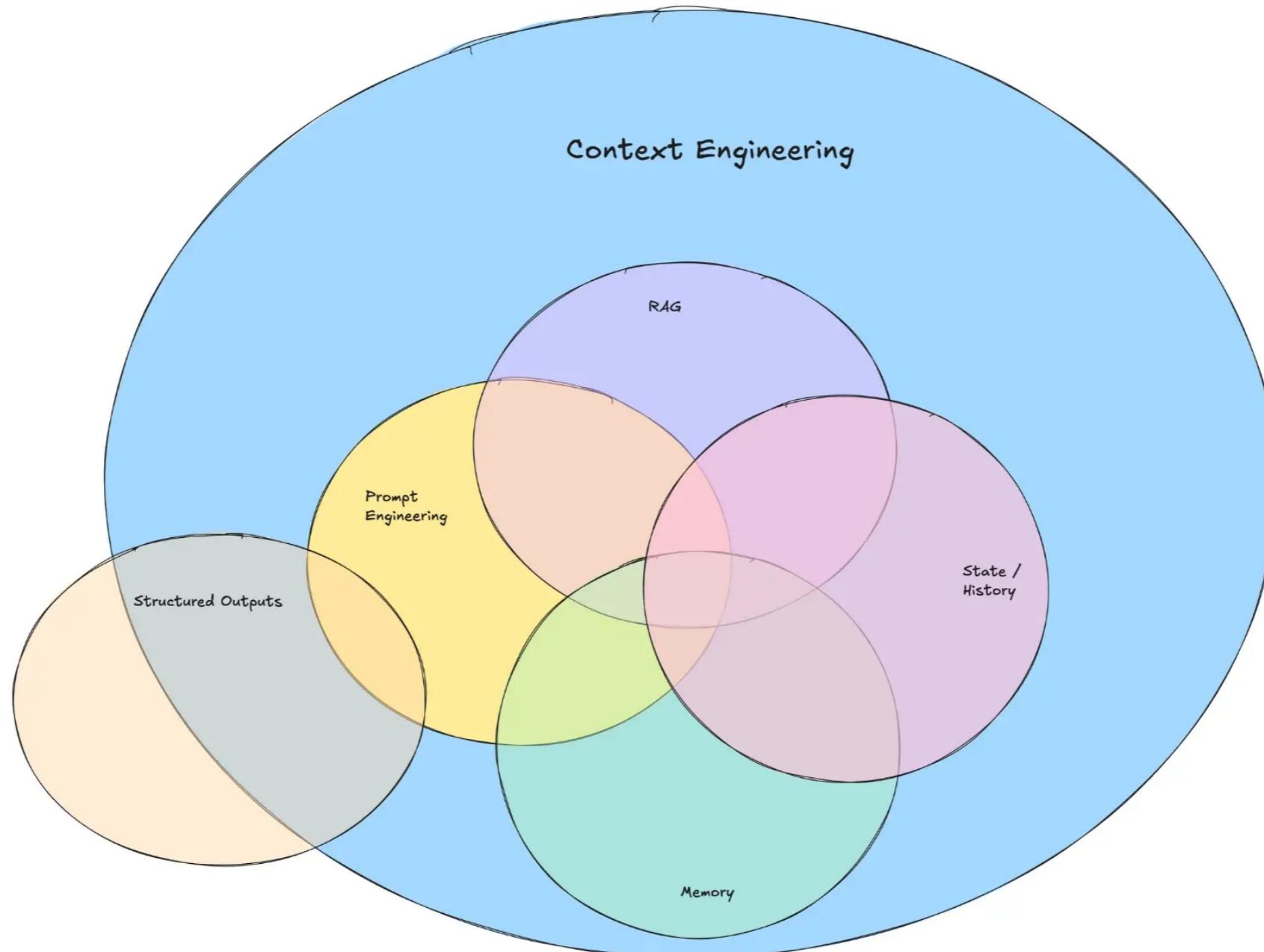
Contextual
retrieval

Vector database
Selection





Context Engineering



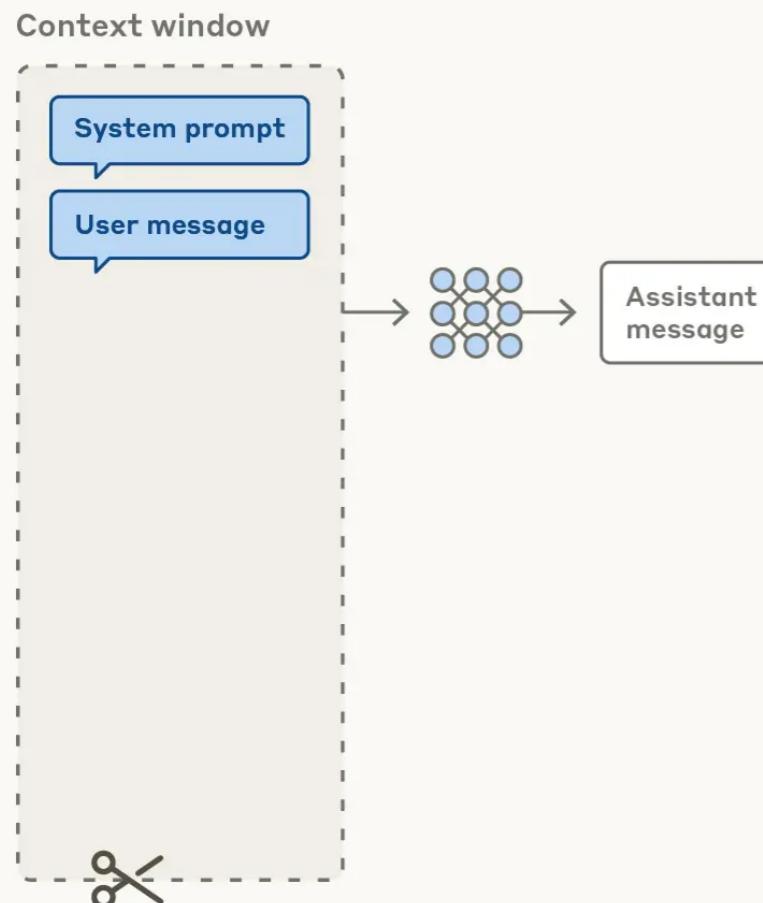
<https://www.promptingguide.ai/guides/context-engineering-guide>



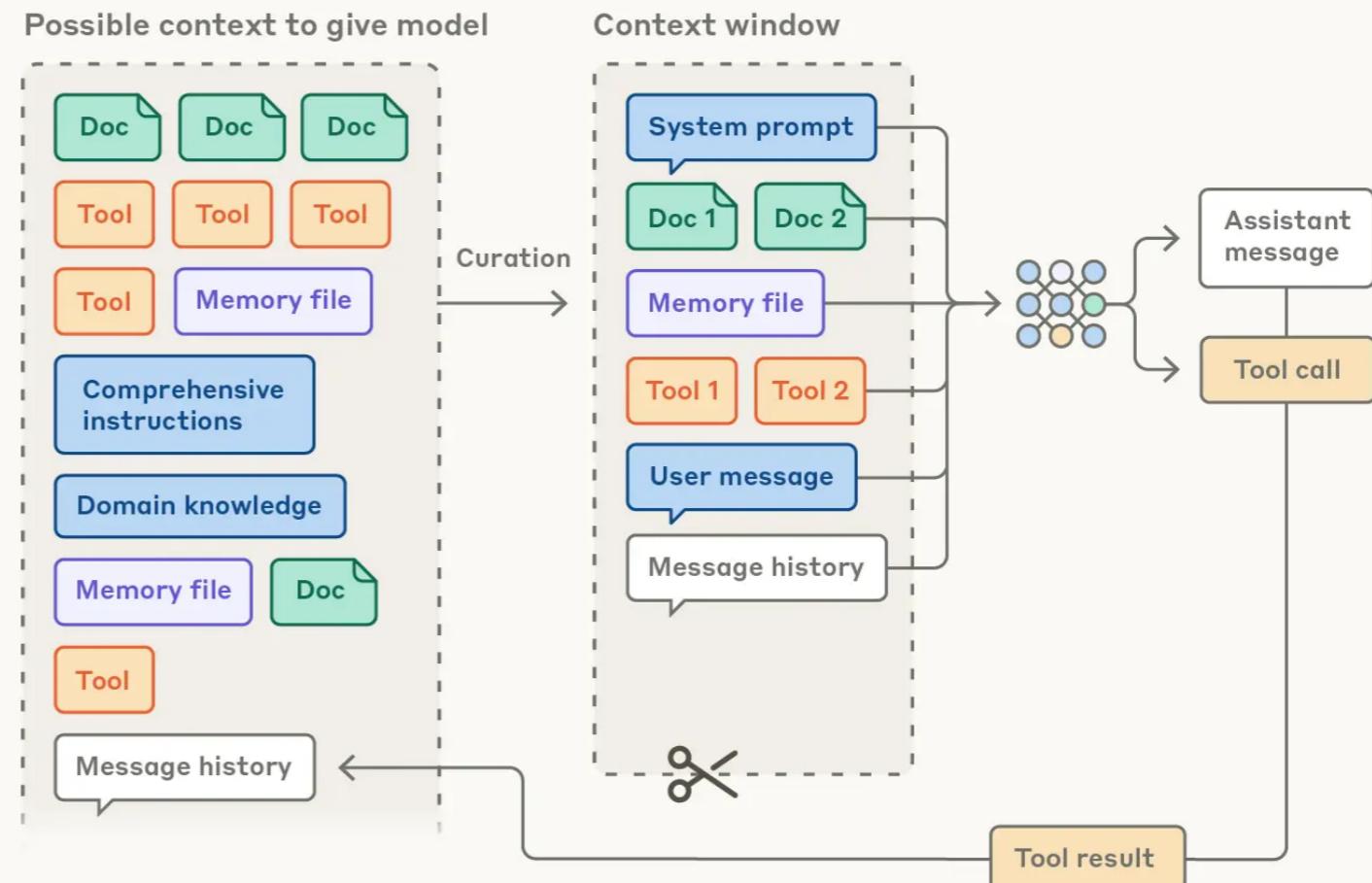
Effective Context Engineering

Prompt engineering vs. context engineering

Prompt engineering
for single turn queries



Context engineering for agents



<https://www.anthropic.com/engineering/effective-context-engineering-for-ai-agents>

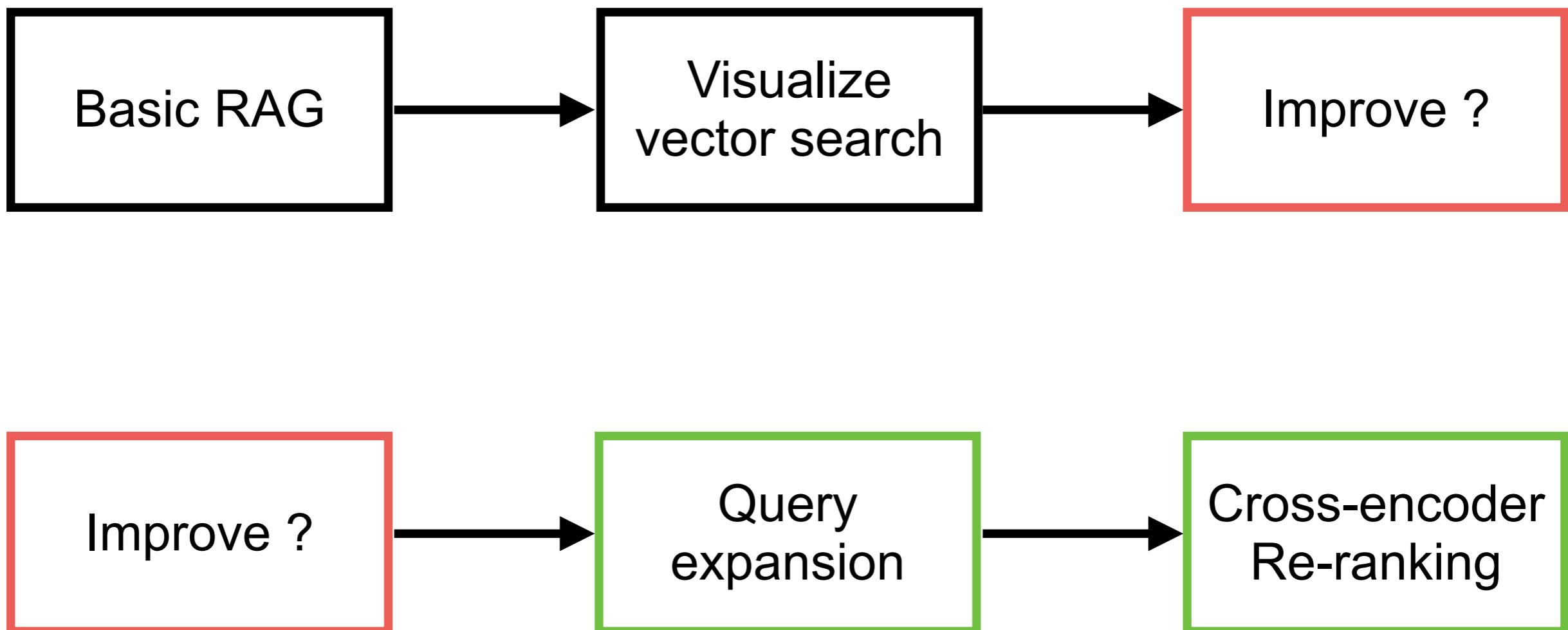


RAG Workshop

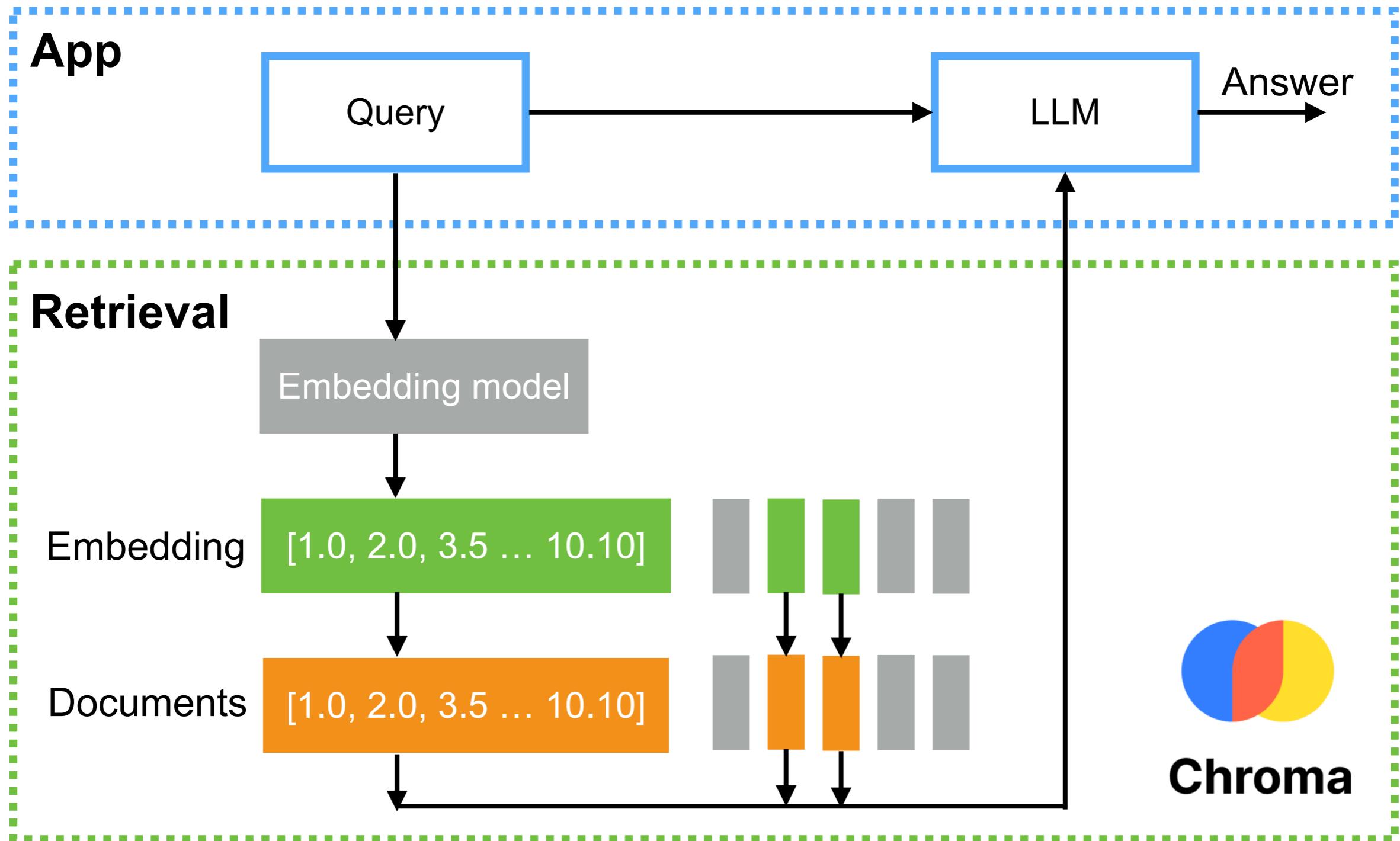
<https://github.com/up1/workshop-basic-llm/tree/main/workshop/basic-rag>



RAG workshop



Basic RAG



Query Expansion

Query expansion is a widely used technique to improve the recall of search systems

Ambiguity

Vocabulary
mismatch

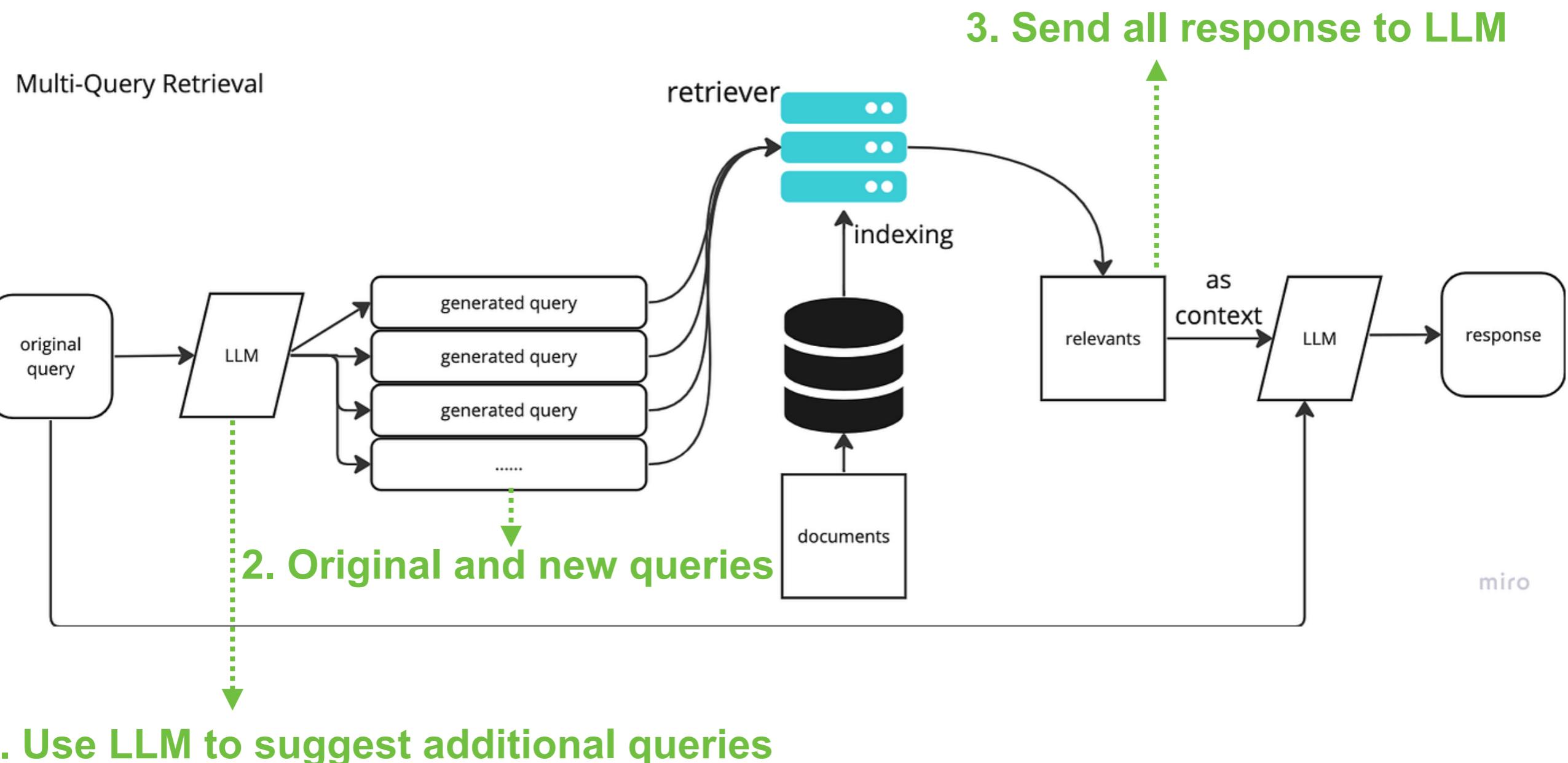
Lack of context

“Add synonyms, related context and contextual terms”

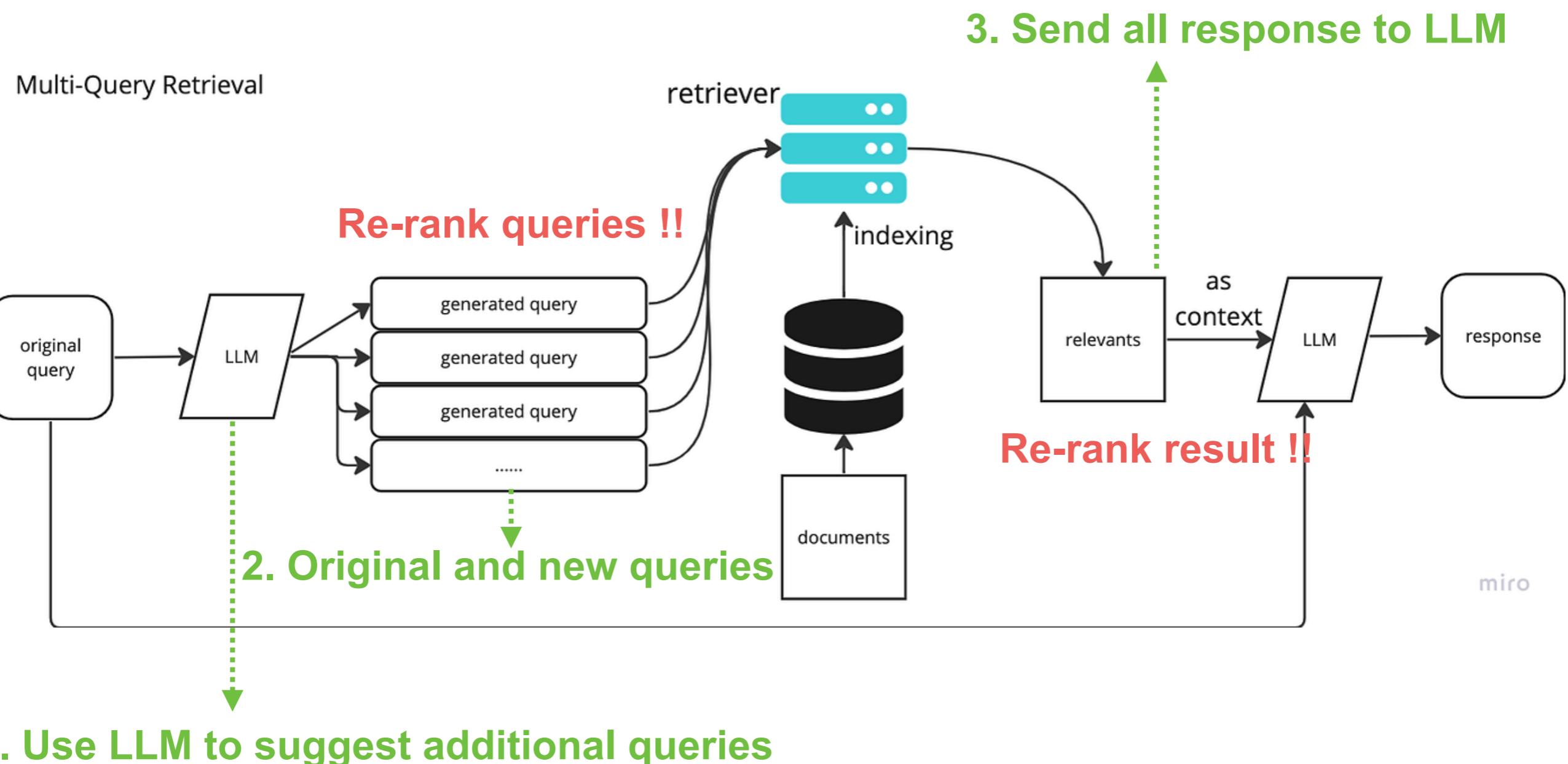
<https://arxiv.org/abs/2305.03653>



Query Expansion

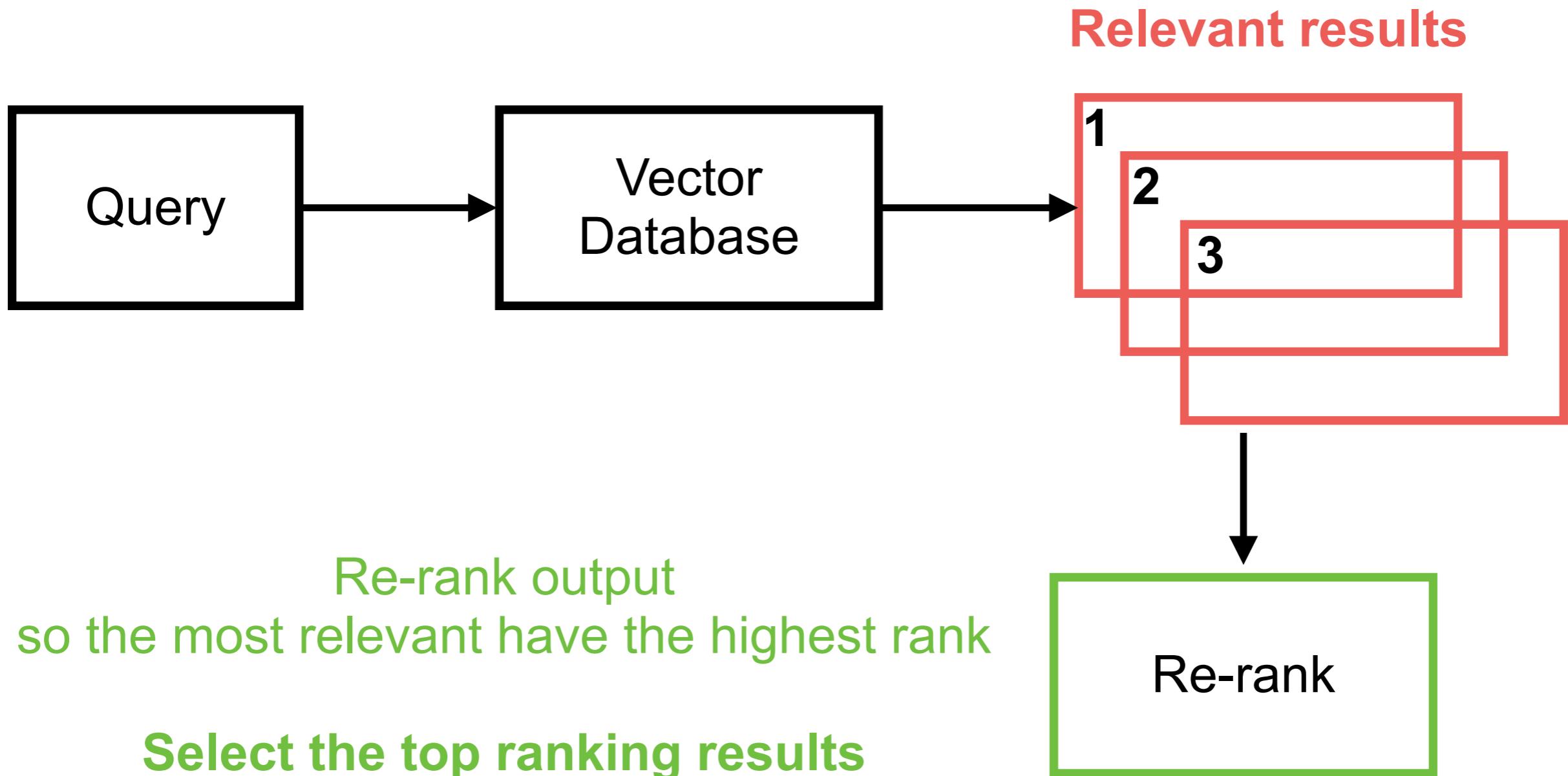


Re-rank !!

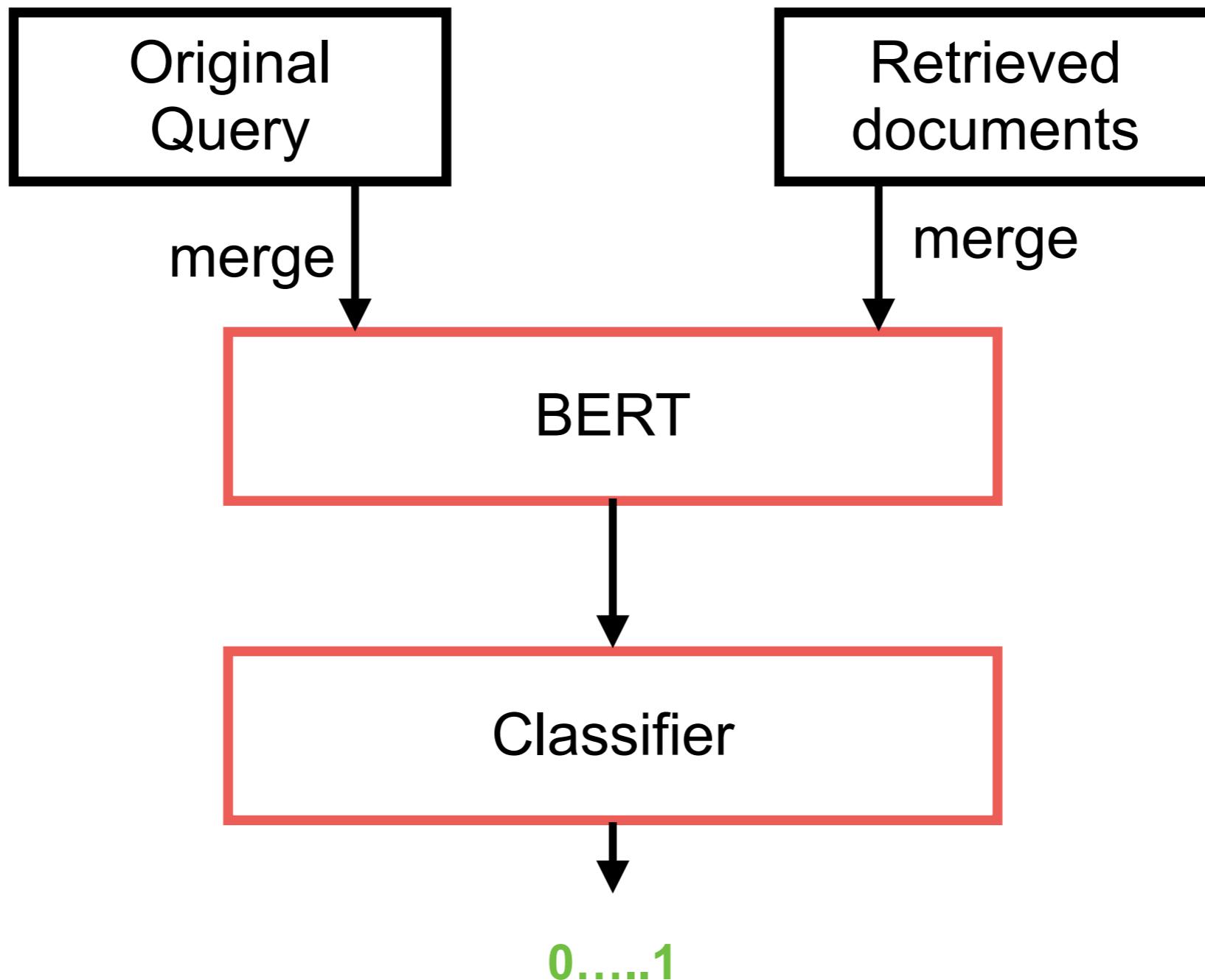


Cross-encoder Re-ranking

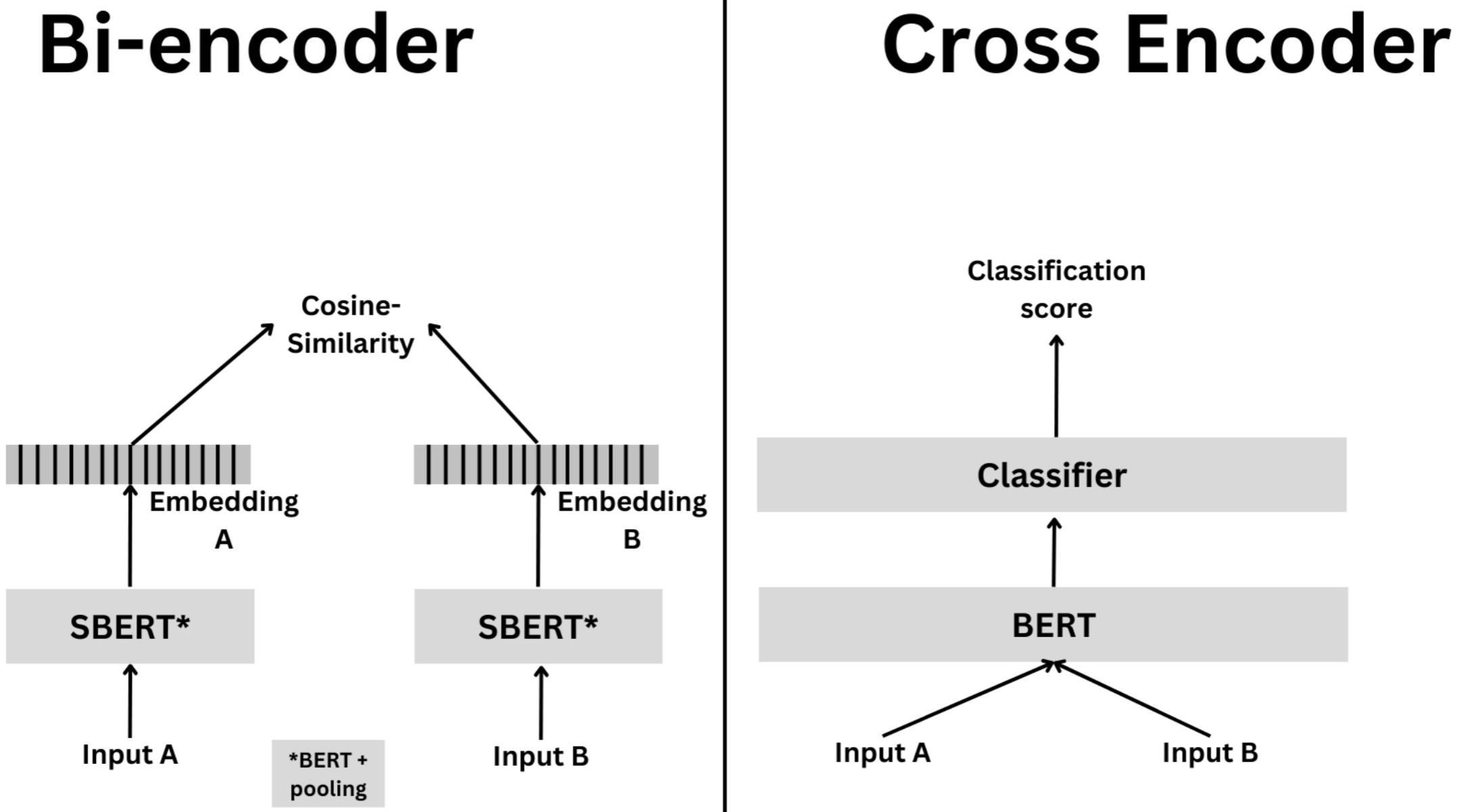
How to ordering relevant results !!



Cross-Encoder



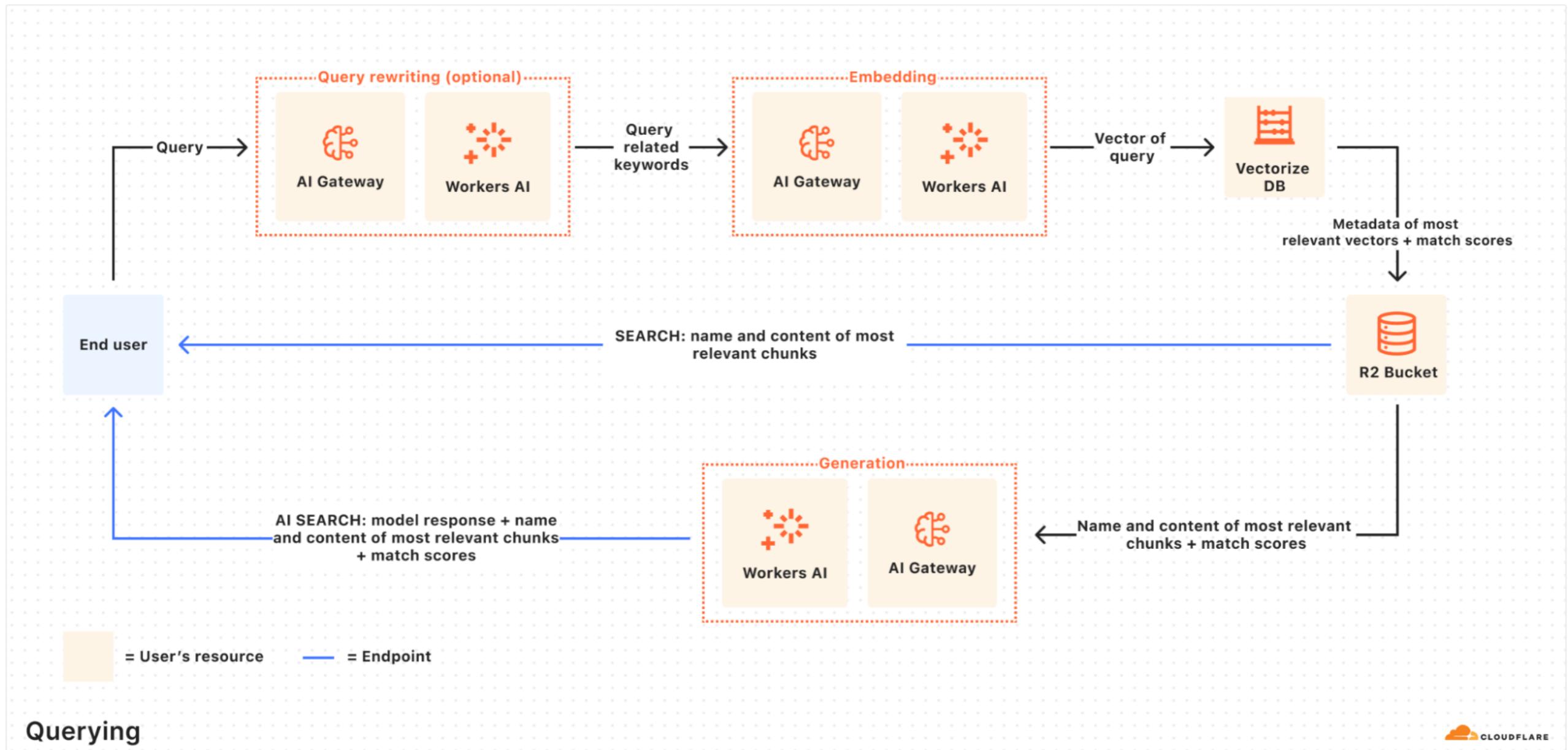
Cross-Encoder !!



https://sbert.net/examples/cross_encoder/applications/README.html



Cloudflare AutoRAG



Guardrails



<https://github.com/guardrails-ai/guardrails>



Guardrails

Help to build reliable AI applications

Guard for
input and output

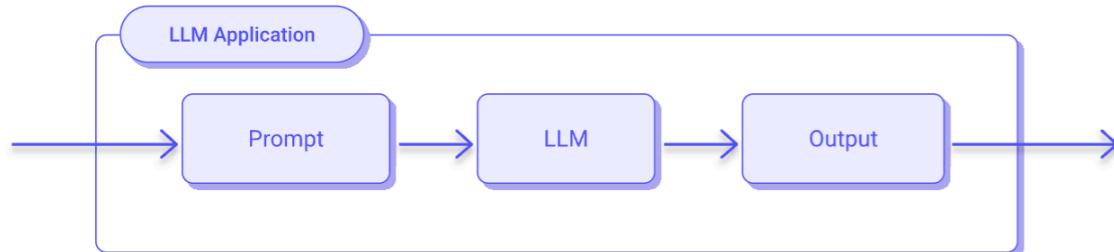
Help to generate
Structured output

<https://github.com/guardrails-ai/guardrails>

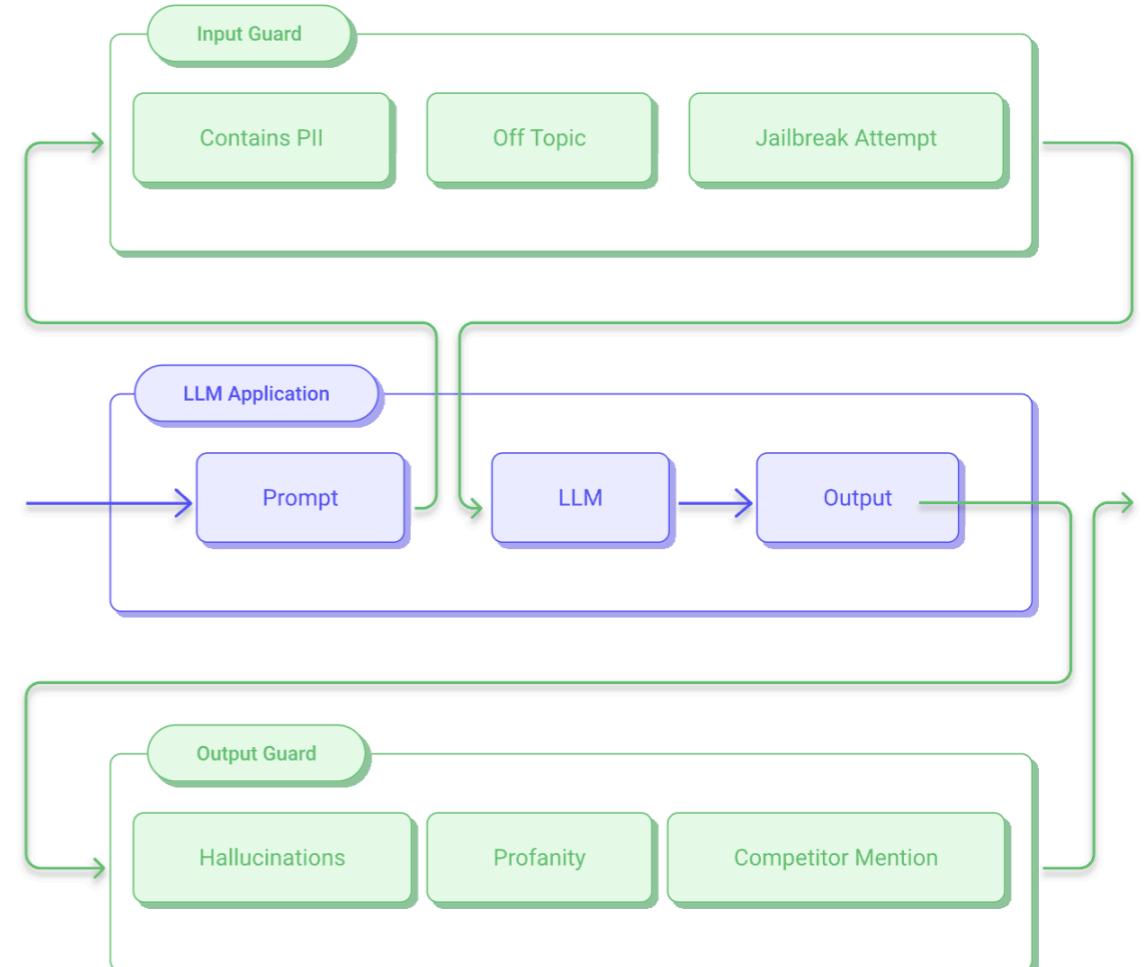


Guardrails

Without Guardrails



With Guardrails



Guardrails Hub

 **Guardrails AI**

Hub Blog Docs  

Validators

Validators are basic Guardrails components that are used to validate an aspect of an LLM workflow. Validators can be used to prevent end-users from seeing the results of faulty or unsafe LLM responses.

Search: Showing 66 of 66 validators

Generate Code

Arize Dataset Embeddings Validates that user-generated input does not match the dataset of jailbreak... Last updated 6 months ago  STRING BRAND RISK	Ban List Validates that the output does not contain banned words, using fuzzy search. Last updated 8 months ago  STRING BRAND RISK
Bespoke MiniCheck Validates that the LLM-generated text is supported by the provided context using... Last updated 7 months ago  STRING BRAND RISK FACTUALITY	Bias Check Validates that the text is free from biases related to age, gender, sex, ethnicity,... Last updated 1 week ago  STRING BRAND RISK
Competitor Check Flags mentions of competitors. Fixes responses by filtering out competitor names. Last updated 5 months ago   STRING BRAND RISK	Correct Language Validate that an LLM-generated text is in the expected language. If the text is not ... Last updated 11 months ago   STRING ETIQUETTE
Cucumber Expression Match Validates that the input string matches a specified cucumber expression. Last updated 6 months ago  STRING BRAND RISK	Detect PII Detects personally identifiable information (PII) in text, using Microsoft Presidio. Last updated 6 months ago   STRING DATA LEAKAGE

USE CASES: CHATBOTS, CUSTOMER SUPPORT, STRUCTURED DATA, RAG, SUMMARIZATION, CODEGEN, TEXT2SQL

RISK CATEGORY: ETIQUETTE, BRAND RISK, FACTUALITY, FORMATTING, INVALID CODE, JAILBREAKING, CODE EXPLOITS, DATA LEAKAGE

INFRASTRUCTURE REQUIREMENTS: ML, LLM, NA, RULE

CONTENT TYPE: STRING, OBJECT, LIST, INTEGER, FLOAT, SQL, CODE, CSV, PYTHON

CERTIFICATION: GUARDRAILS CERTIFIED

LANGUAGE: EN

<https://hub.guardrailsai.com/>



Guardrails Index

AI Guardrails Index

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AI Guardrails Categories

We broke AI safety down into 6 categories and curated datasets and models that demonstrate the state of AI guardrails using LLMs and other open source models.

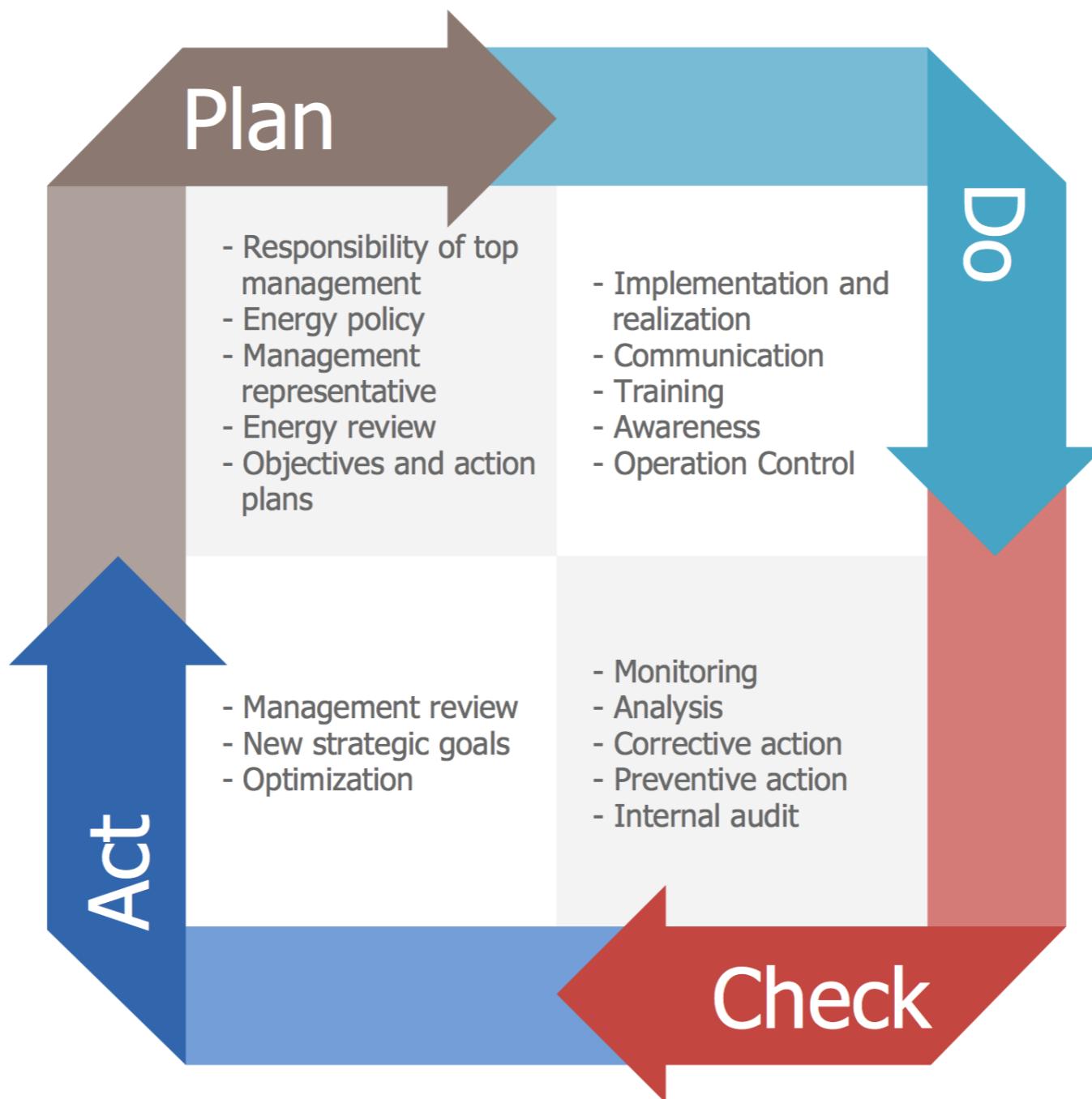
<https://index.guardrailsai.com/>



Workshop with IDE

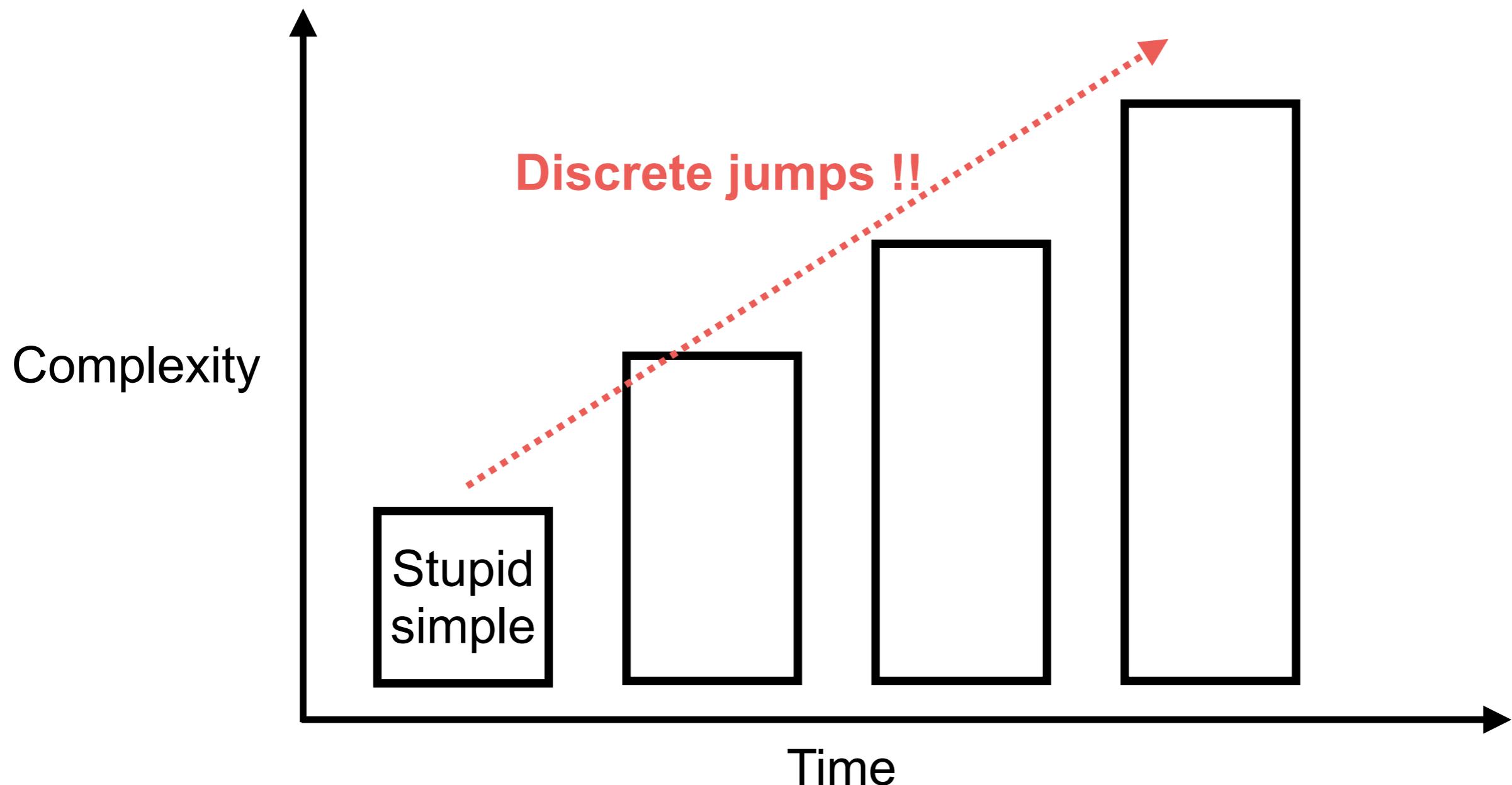


PDCA process

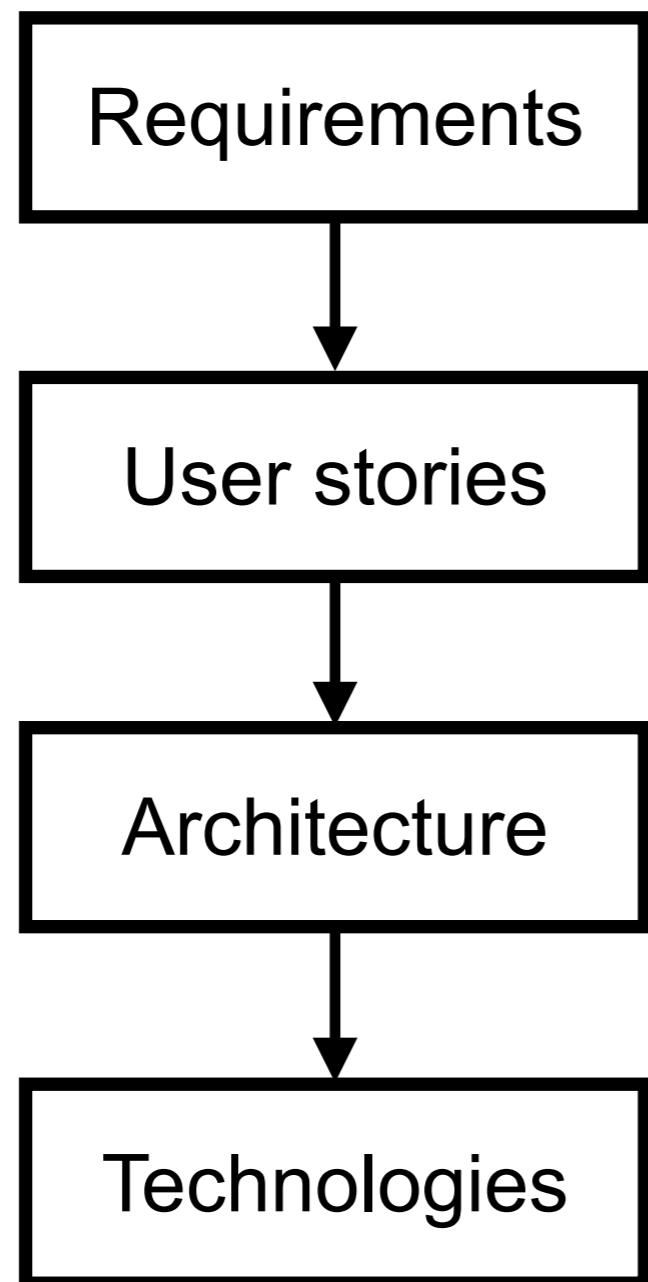


Staged Complexity

Start small and get a feature working first



Planning workflow



What you're build ?

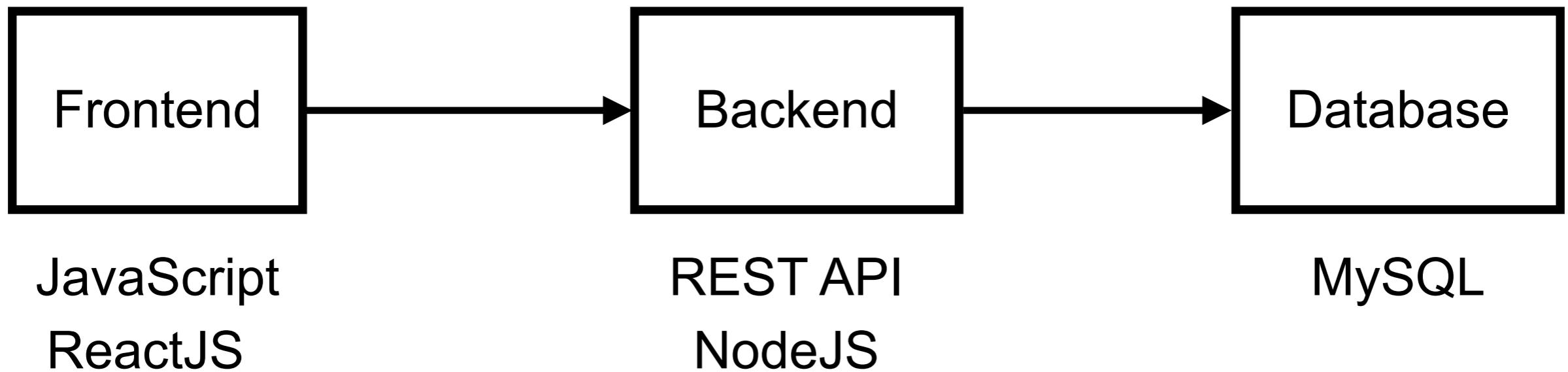
What use need ?

Selection ?

Selection ?



Architecture of project

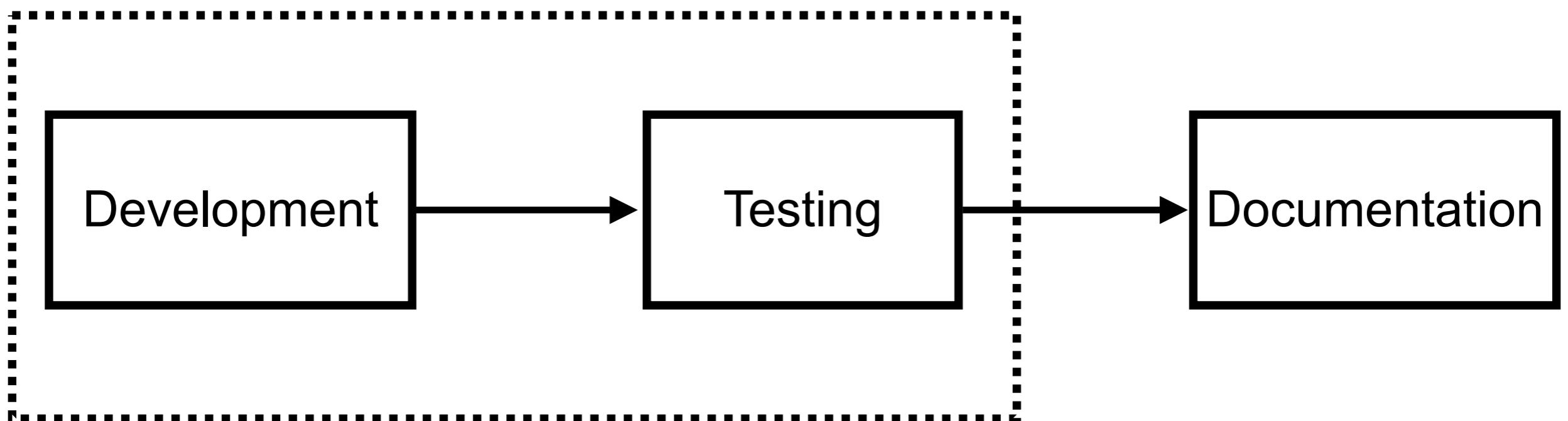


Choose your tech stack !!



Processes

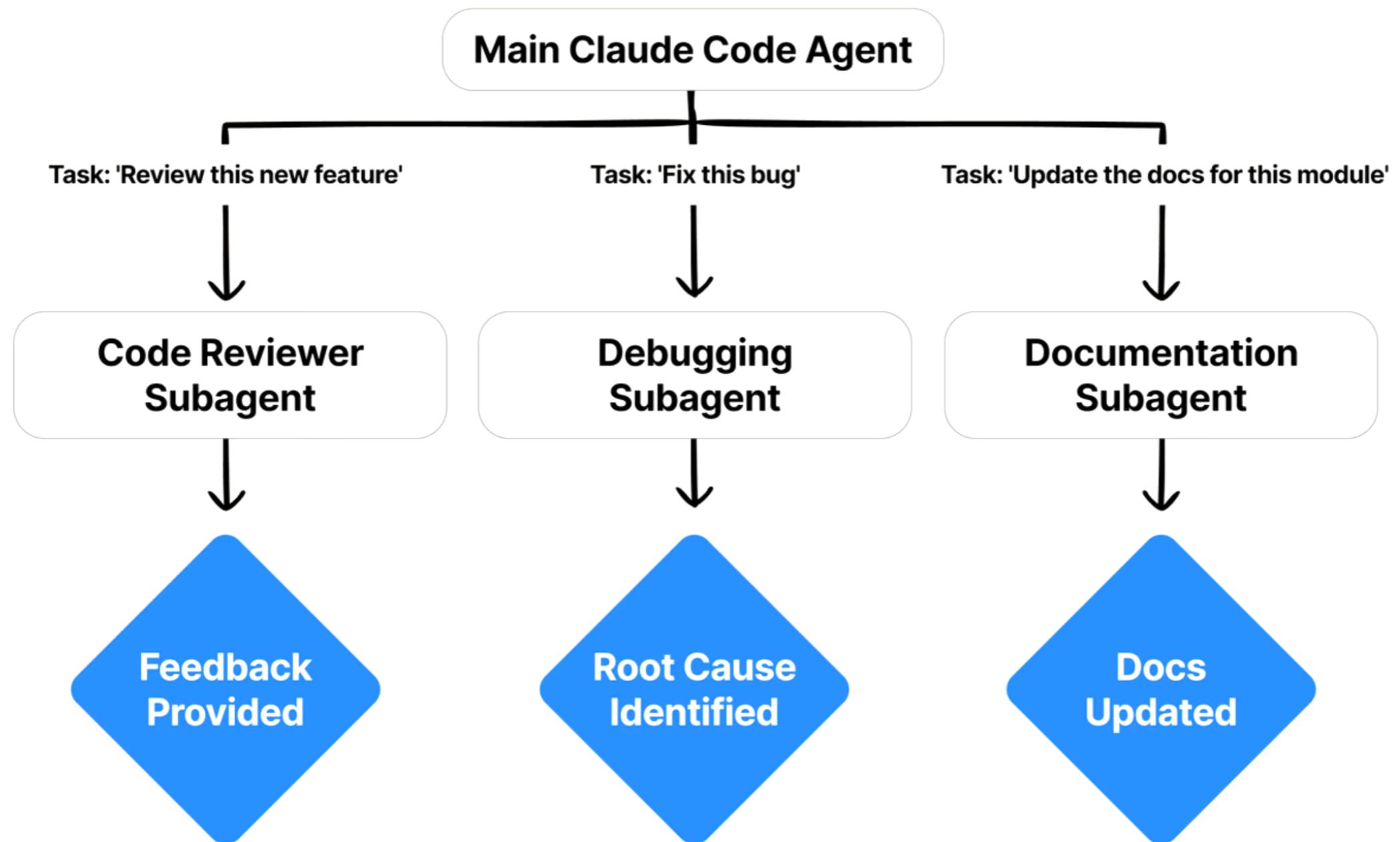
Iterative and incremental process



AI Subagent



AI Subagent



<https://code.claude.com/docs/en/sub-agents>



AI Subagent



<https://github.com/VoltAgent/awesome-claude-code-subagents>



Start your journey

