

LLM-powered Automated Workflow Management

EnergyNorway 2024

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NCS2030 WP5

Previous In Energy Norway



Federated Knowledge Cloud Blockchain-Powered Digital Asset Management and Access Control for Federated Learning

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Introduction

The Federated Knowledge Cloud (**FedKC**) is a platform where participants can collaborate in the machine learning process through **federated learning**. To ensure the security and trustworthiness of the platform, we propose the system design of a robust asset management system using **Decentralized Identities (DIDs)** to represent tokenized assets, such as data and models, and prove ownership and establish a clear chain of custody. Additionally, to automate access control and align with Zero Trust Architecture principles, we will utilize **smart contracts** to verify and authenticate users and their actions, allowing for the immediate revocation of access if necessary. This smart contract-based system will ensure the security and automation of the **FedKC** and foster a collaborative and secure environment for data and model training.

Objectives

- Collaboration and knowledge sharing by **moving computation where data is**.
- Providing secure and privacy-preserving **digital asset management** and **access control**.

Results

1. Joining FedKC

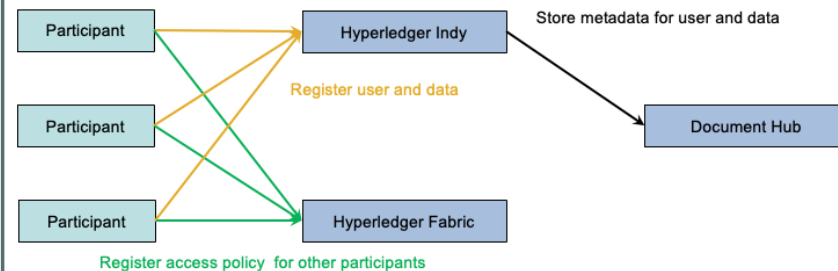
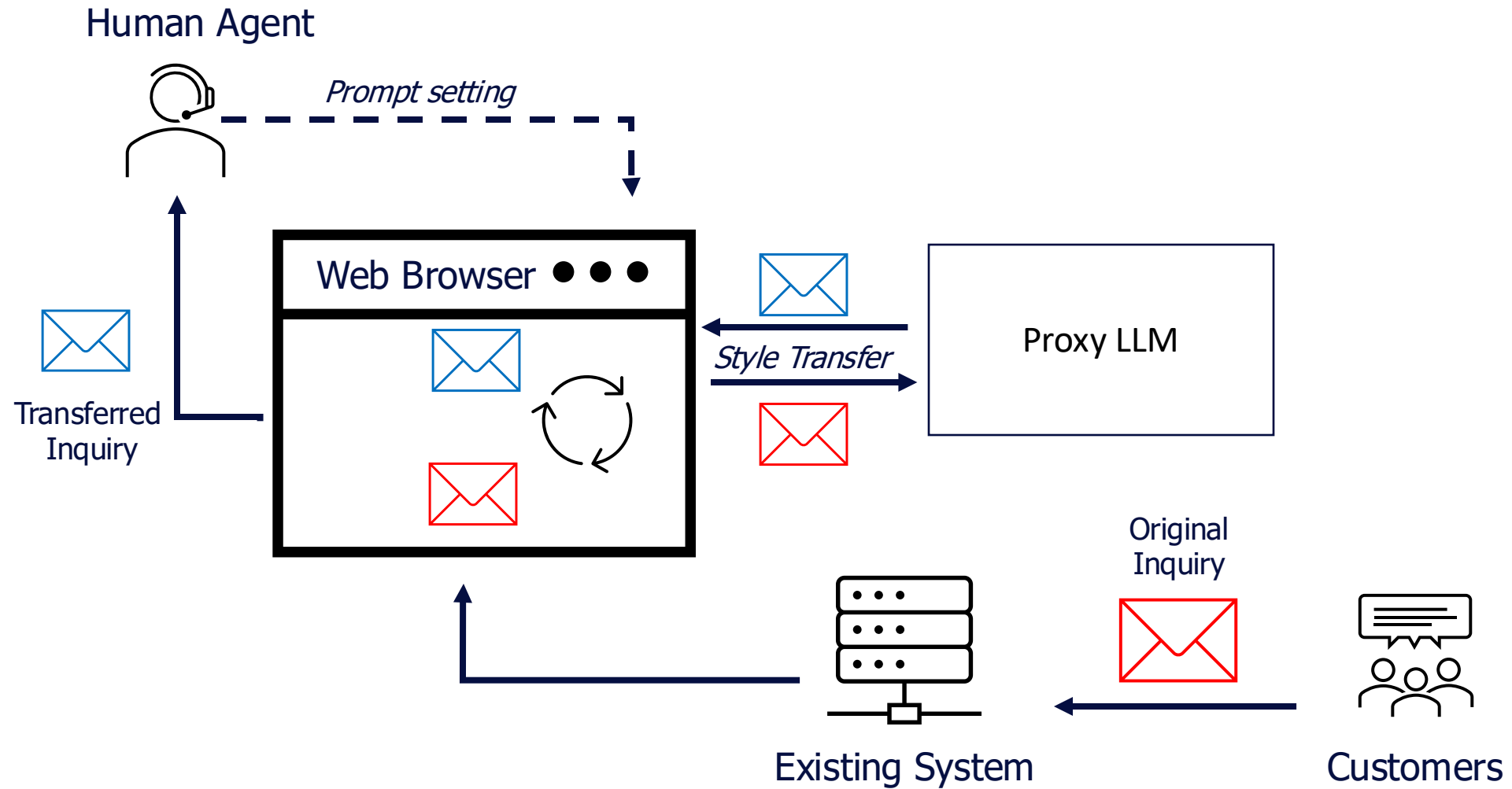


Fig 4. Workflow of user and asset registration

2. Running Federated Learning (FL)



Federated Knowledge Cloud

Federated Knowledge Cloud
(FedKC)

?

Large Language Model



Blockchain

(Access Control, Digital Asset Management, Incentive)

Large Language Model (LLM)

Large Language Model in Energy Industry



EAGE						
HOME ABOUT PROGRAMME SPONSORING & EXHIBITION REGISTRATION CONTACT US						
Monitoring II						
4:10 PM - 5:30 PM		Geological Case Studies				OSDU Development & Case Studies
Thursday, June 13, 2024						
	Geophysics	Geophysics	Geology	Reservoir Engineering & Integrated Subsurface	Energy Transition & Mining and Infrastructure	Dedicated Sessions
8:30 AM - 9:50 AM	ML/AI for Seismic Processing - Image Enhancement		Outcrop Analogues			Data and Computer Science
8:30 AM - 11:30 AM	4D Reservoir Monitoring I	PWT - Case Histories	ML for Geological Characterization	ML & AI for Production Optimization & Forecast	CCS - Monitoring Case Studies	DS-10 - Structure Geology Methods and Applications for the Energy Transition
	High Resolution for Shallow Subsurface	ML & AI for Seismic Inversion	Petroleum Systems I	Multi-Disciplinary Studies II	Seismic Methods for Geothermal	DS-13 - CCS for a Net-Zero Economy
		Rock Physics: Anisotropy, Cracks and Fluids				

Information Management and Large Language Models

Tracks **Data and Computer Science**

Thursday, June 13, 2024
8:30 AM - 11:30 AM
Room 7 (Hall E)

Speaker



Ms Theresia Maria Citraningtyas
Geo / Data Scientist
Earth Science Analytics

Big Data Well Conditioning for Norwegian Continental Shelf

Dr Nevena Stolba
OMV

Building a Data Analytics Platform - Key to success of AI Solutions for Energy Transition

Ruaa Alohal
Upstream

Revolutionary Geological Interpretation Framework and Robust Data Repository Transforming Real-Time Drilling Operations

Mr Jintao Li
University of Science and Technology of China

CIGVis: an open-source python tool for real-time interactive visualization of multidimensional geophysical data

Mr Jungwon Seo
University Of Stavanger

Federated AI Chat System: Tackling Tacit Knowledge Management

Ms Anna Dubovik
WAIW

Advanced LLM applications in Oil & Gas: cross-domain implementations



Mr Rafael Valladares de Almeida
Repsol Sinopec Brasil

Geologist Copilot: Generative AI Application to Support Drilling Operations with Automated and Explained Lithology Interpretation



Dr Diego Rovetta
Science Specialist
Aramco Overseas Company BV

Building a Large Language Model based seismic data processing assistant

Chairperson

Henri-Pierre Valero
SLB

Large Language Model in Energy Industry



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Federated AI Chat System: Tackling Tacit Knowledge Management



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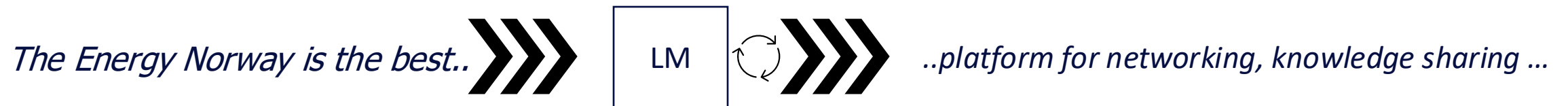
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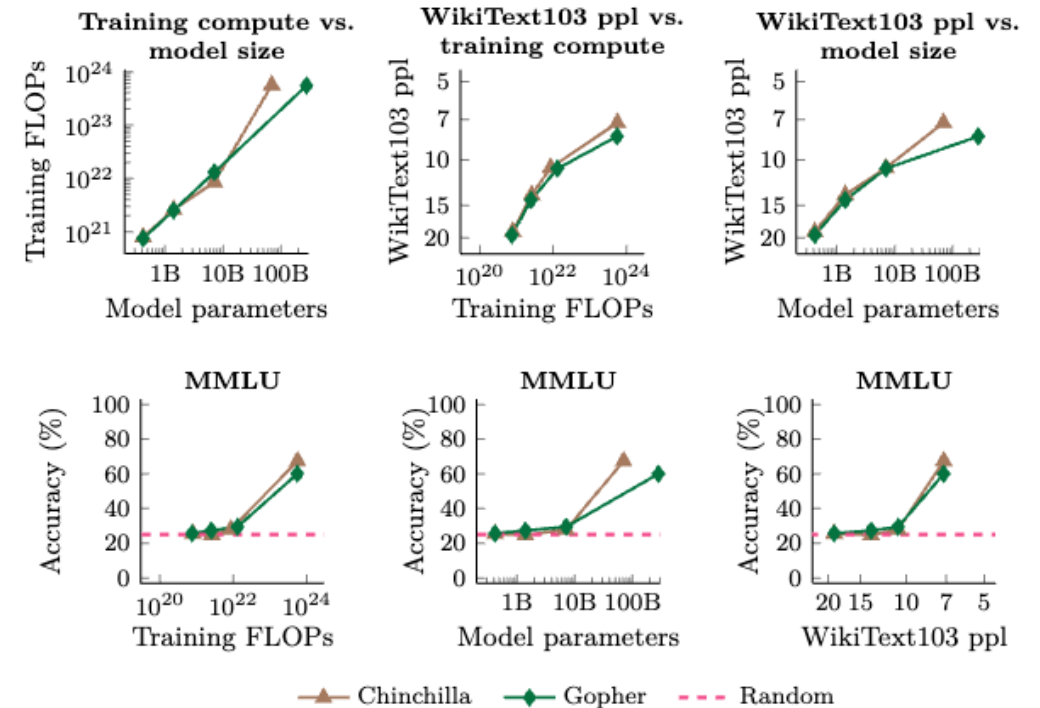
Large Language Model

Probabilistically predicting next words



“Large” Language Model vs. Language Model

- Architecture point of view:
 - Larger parameter
- Performance point of view:
 - Emergent Abilities
 - Not explicitly trained ability
 - General-purpose
 - Task-specific: Machine Translation



What LLM (solely) can / cannot

○ **Can**

- Understand and generate text
- Answer questions
- Translate languages
- Summarize content
- Predictive text and autocompletion
- ...

○ **Cannot**


- Access to real-time information
- Calculate precise mathematical operation
- ...


○ **We need to differentiate between LLM and ChatGPT**

- ChatGPT 4 is a complete system in addition to LLM.

Example: Mathematical Calculation


ChatGPT 3.5 ▾


 **You**
9845*8541

 **ChatGPT**
9845 multiplied by 8541 equals 84,134,745.



ChatGPT 4 ▾

 **You**
9845*8541

 **ChatGPT**
The result of multiplying 9845 by 8541 is 84,086,145. [\[-\]](#)



Example: Real-time Information Access 1

ChatGPT 3.5 ▾



You

Who is the winner of ATP Miami Open 2024



ChatGPT

I'm sorry, but I can't provide real-time information as my training only includes data up to January 2022, and I don't have access to the internet to fetch real-time data. To find the winner of the ATP Miami Open 2024, I suggest checking the latest news updates, the official ATP website, or reliable sports news sources.

ChatGPT 4 ▾



You

Who is the winner of ATP Miami Open 2024



ChatGPT

Jannik Sinner won the ATP Miami Open 2024, defeating Grigor Dimitrov in the final with a score of 6-3, 6-1 ([ATP Tour](#)).

Example: Real-time Information Access 2

ChatGPT 3.5 ▾



You

What time is it now in Norway?



ChatGPT

I'm sorry for any confusion, but as an AI, I don't have real-time capabilities or access to current data such as the current time. Therefore, I can't provide the current time in Norway or any other location. You can easily check the current time in Norway by using various online tools such as world clocks, websites, or smartphone apps.

ChatGPT 4 ▾



You

What time is it now in Norway?



ChatGPT

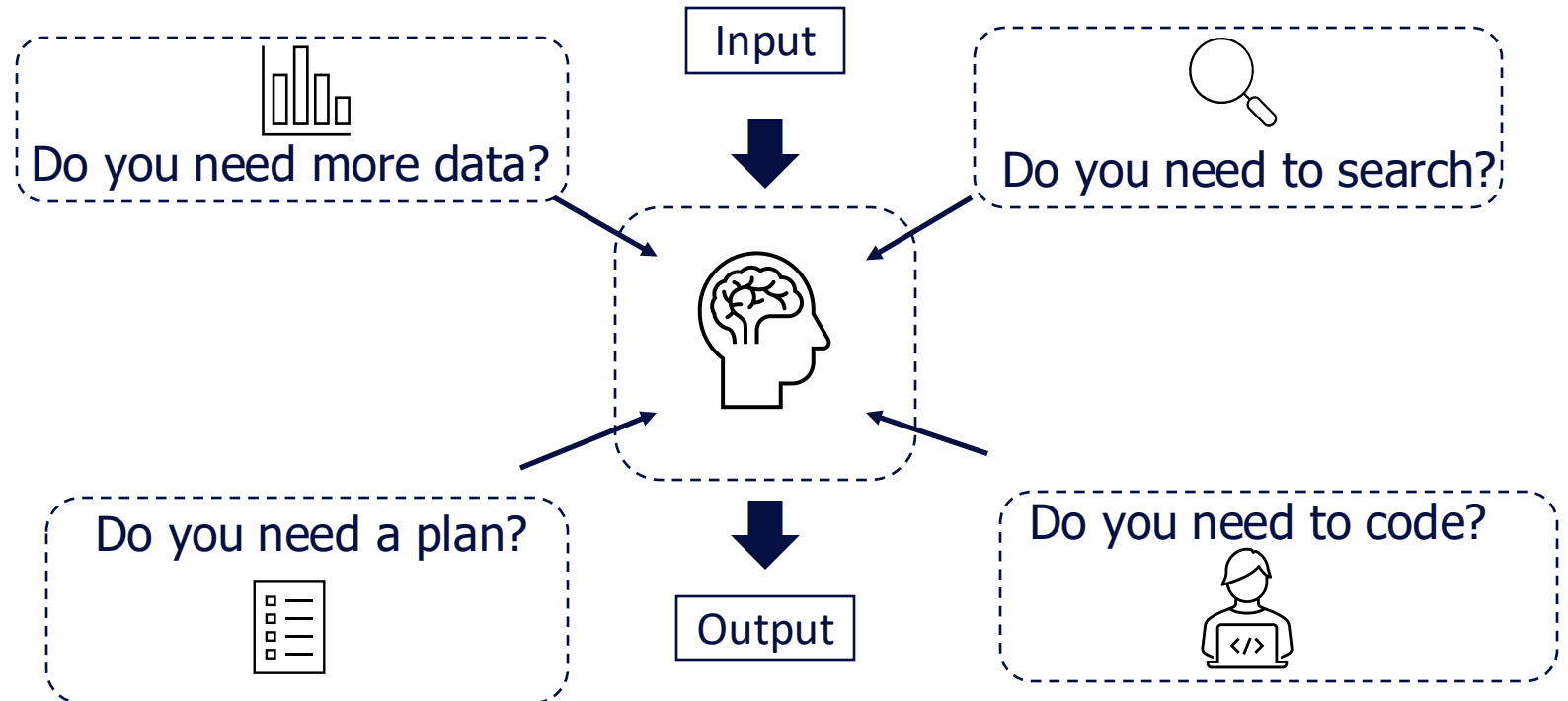
The current time in Norway is 15:33 CEST on April 8, 2024. [\[↗\]](#)

What's the difference?

Non-agentic Workflow (Zero-shot)



Agentic Workflow



LLM-powered Automated Workflow Management (Demo)

+ New Workflow

Home

4X Play Speed

Clear

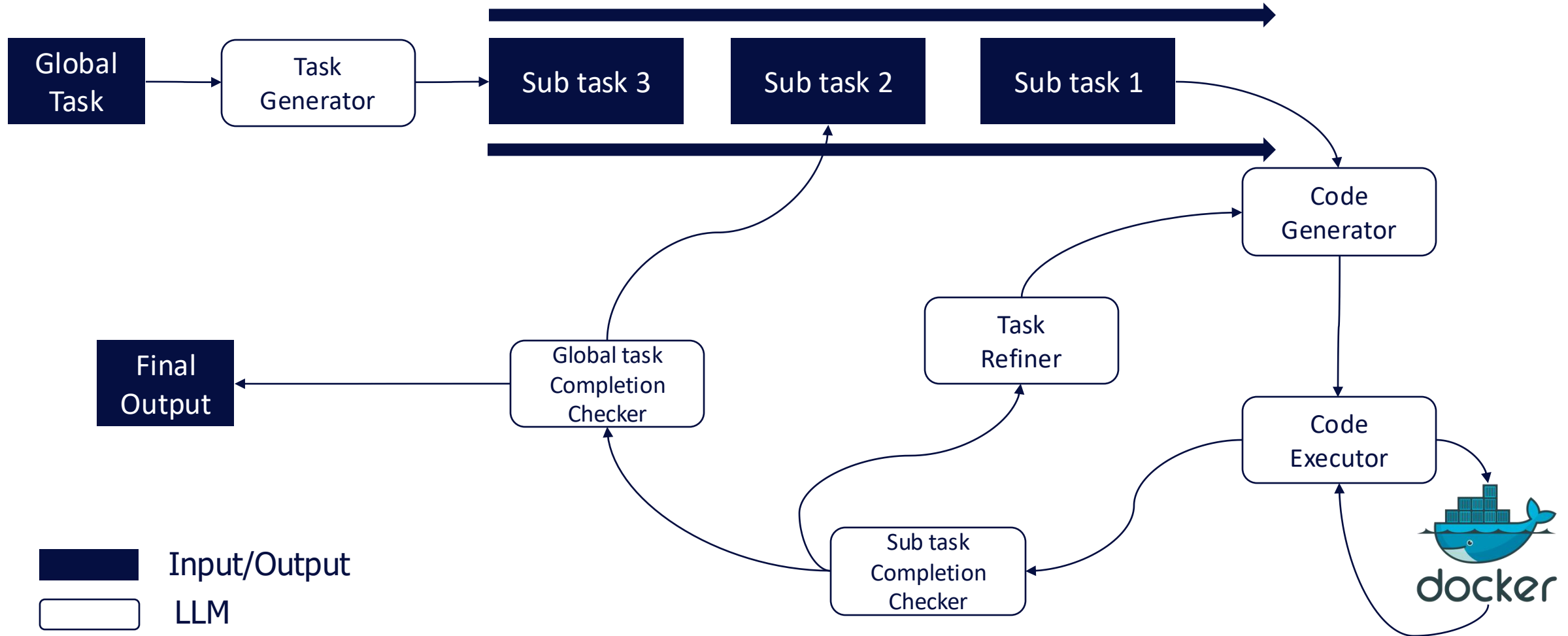
Export



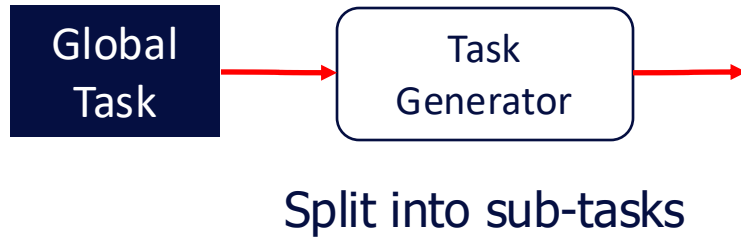
Chat

Log

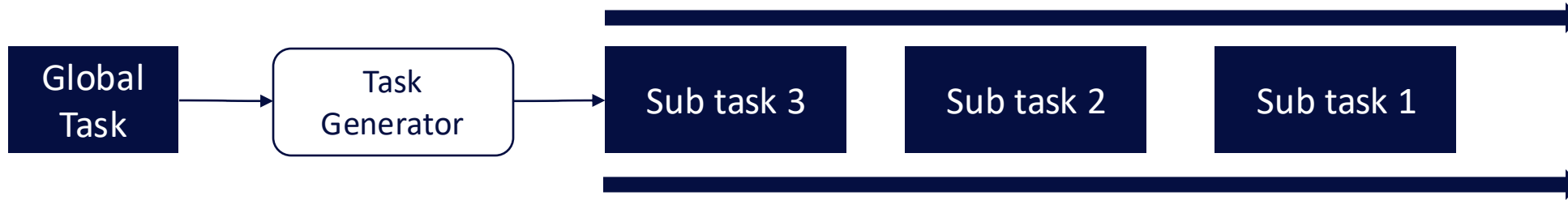
Automated Workflow Management



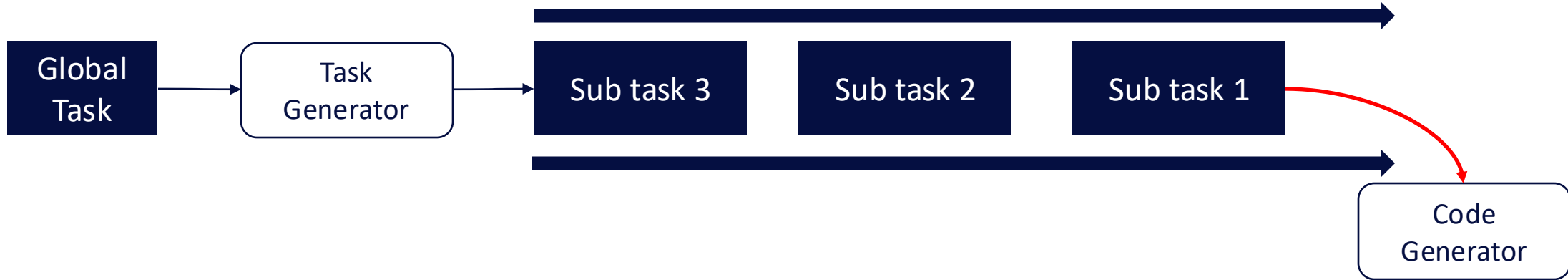
Automated Workflow Management



Automated Workflow Management



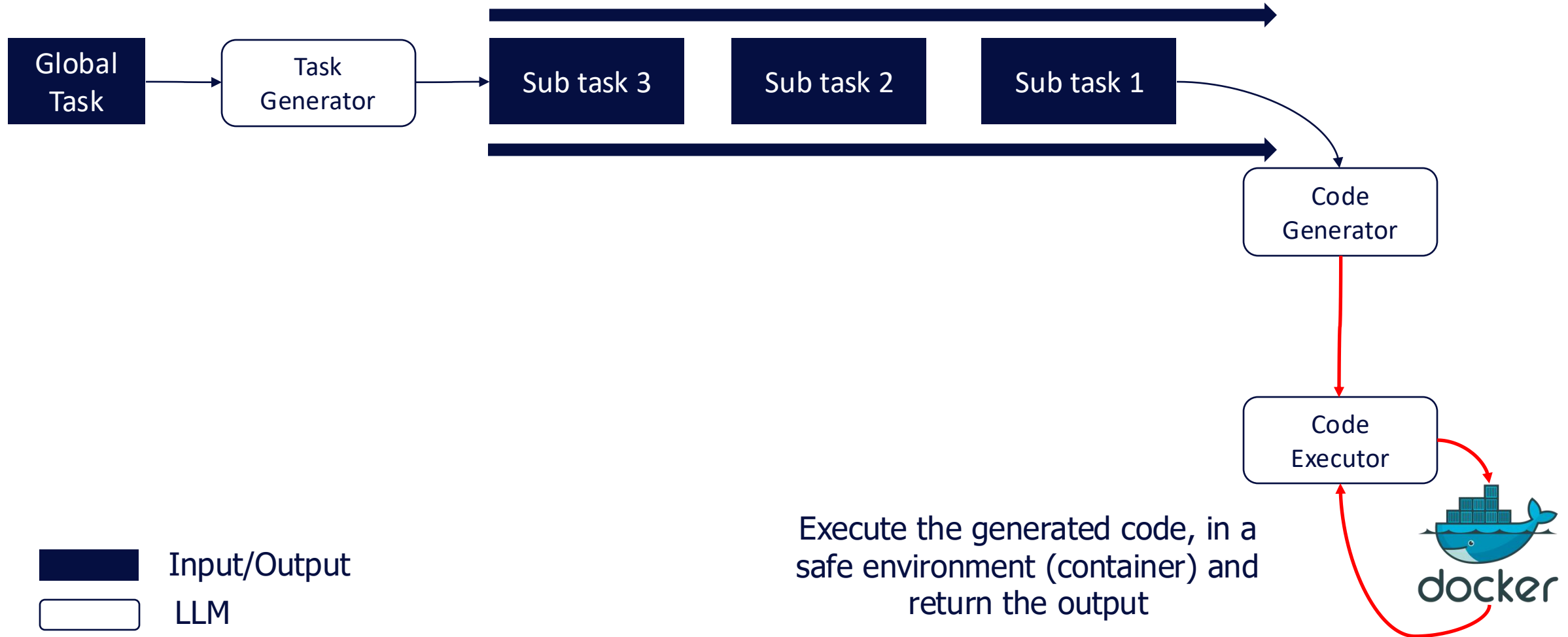
Automated Workflow Management



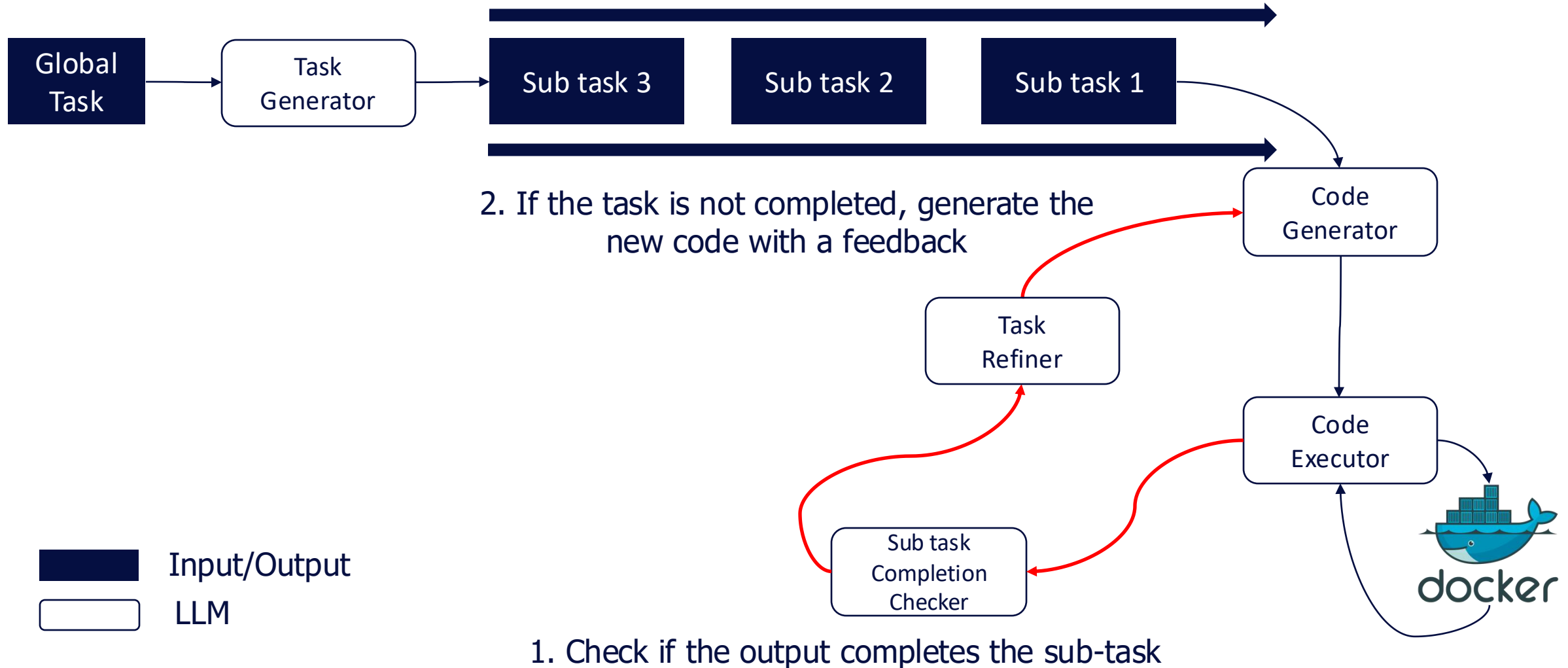
Choose one sub-task and generate a code to solve it.



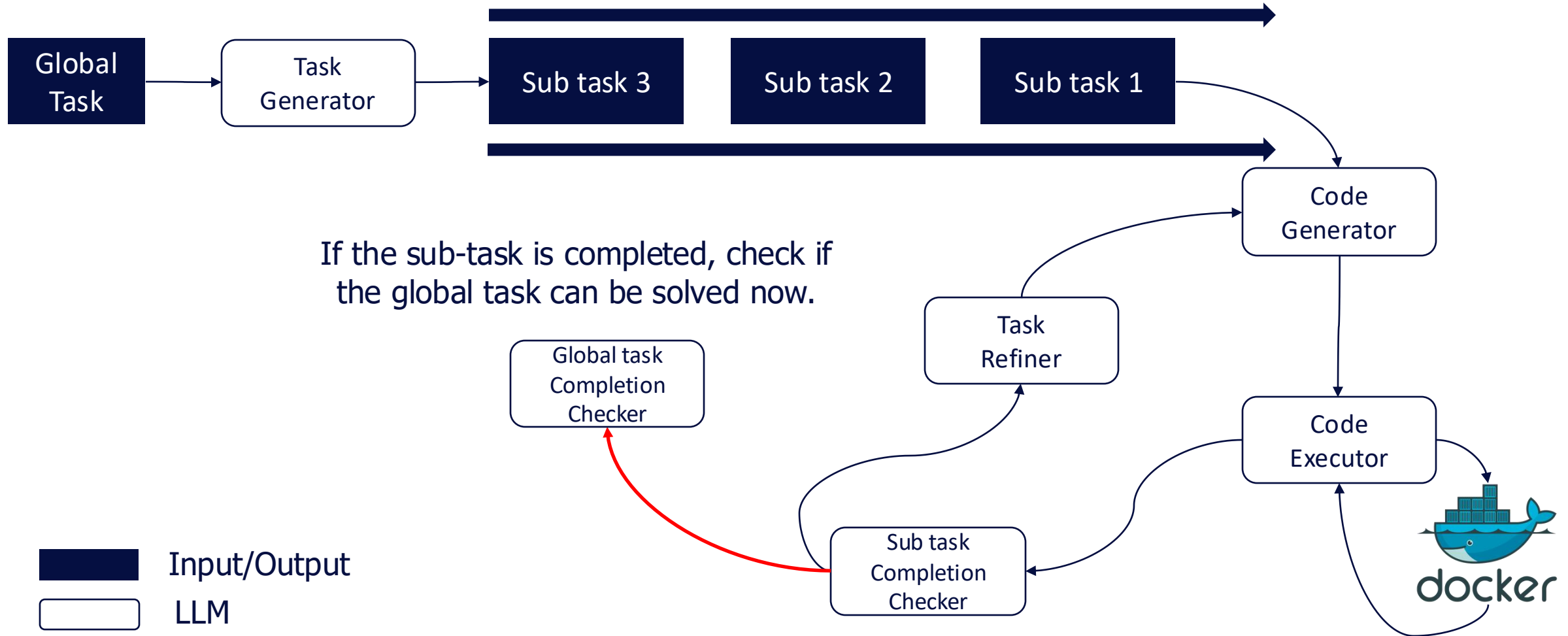
Automated Workflow Management



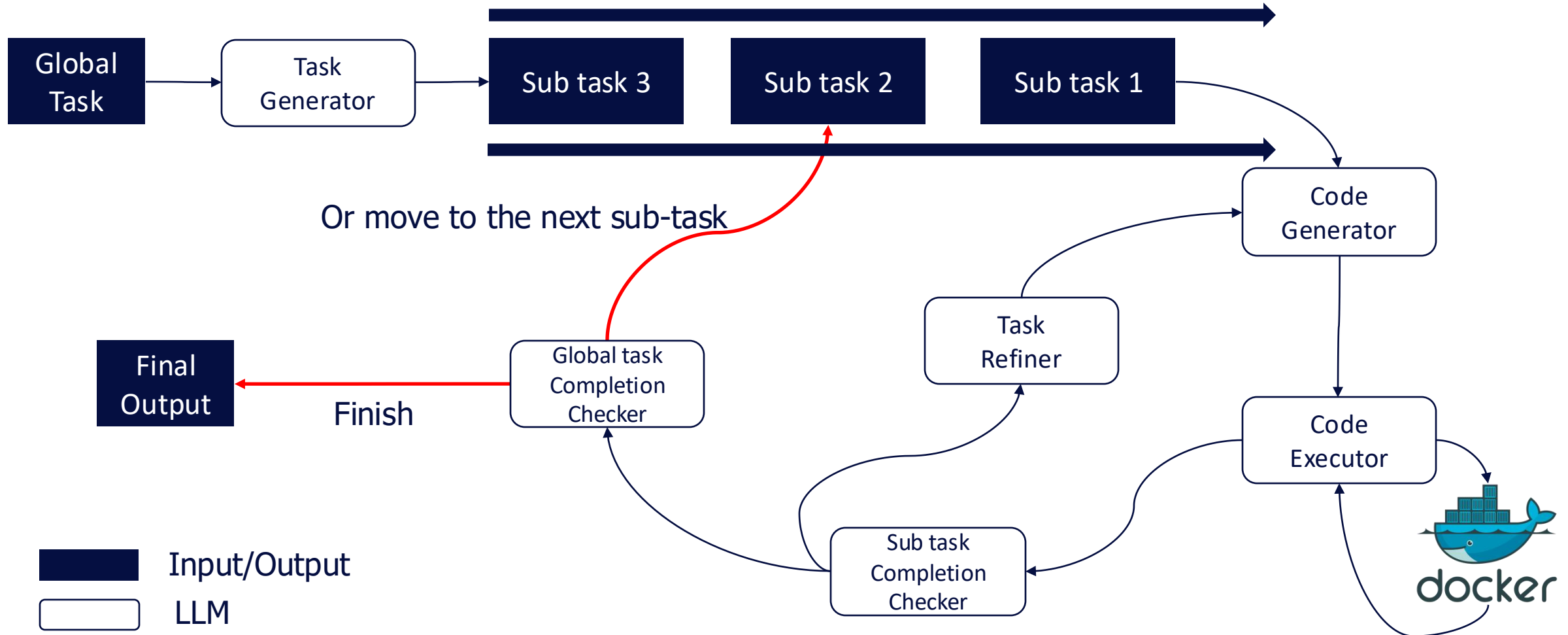
Automated Workflow Management



Automated Workflow Management



Automated Workflow Management



Agentic Reasoning Design Patterns*

○ Reflection

- Madaan, Aman, et al. "Self-refine: Iterative refinement with self-feedback." Advances in Neural Information Processing Systems 36 (2024).
- Shinn, Noah, et al. "Reflexion: Language agents with verbal reinforcement learning." Advances in Neural Information Processing Systems 36 (2024).

○ Tool use

- Patil, Shishir G., et al. "Gorilla: Large language model connected with massive apis." arXiv preprint arXiv:2305.15334 (2023).
- Yang, Zhengyuan, et al. "Mm-react: Prompting chatgpt for multimodal reasoning and action." arXiv preprint arXiv:2303.11381 (2023).

○ Planning

- Wei, Jason, et al. "Chain-of-thought prompting elicits reasoning in large language models." Advances in neural information processing systems 35 (2022): 24824-24837.
- Shen, Yongliang, et al. "Hugginggpt: Solving ai tasks with chatgpt and its friends in hugging face." Advances in Neural Information Processing Systems 36 (2024).

○ Multi-agent Collaboration

- Qian, Chen, et al. "Communicative agents for software development." arXiv preprint arXiv:2307.07924 (2023).
- Wu, Qingyun, et al. "Autogen: Enabling next-gen llm applications via multi-agent conversation framework." arXiv preprint arXiv:2308.08155 (2023).

Robust
technology

Emerging
technology

* Sequoia Capital. (2024, March 26). What's next for AI agentic workflows ft. Andrew Ng of AI Fund [Video]. YouTube. <https://www.youtube.com/watch?v=sal78ACtGTc>

Development Consideration

LLM API (ChatGPT)

Open Source (Local LLM)

Speed

Fast

Local machine dependent

Performance

Great

Parameter size dependent

Cost

High

Low

Privacy

Low

High



Development Consideration

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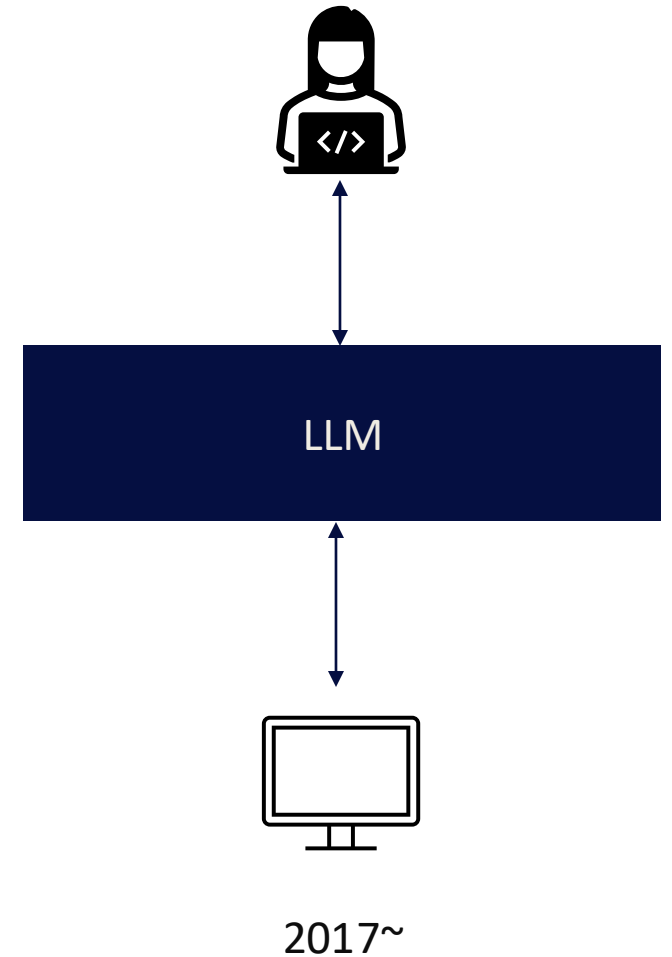
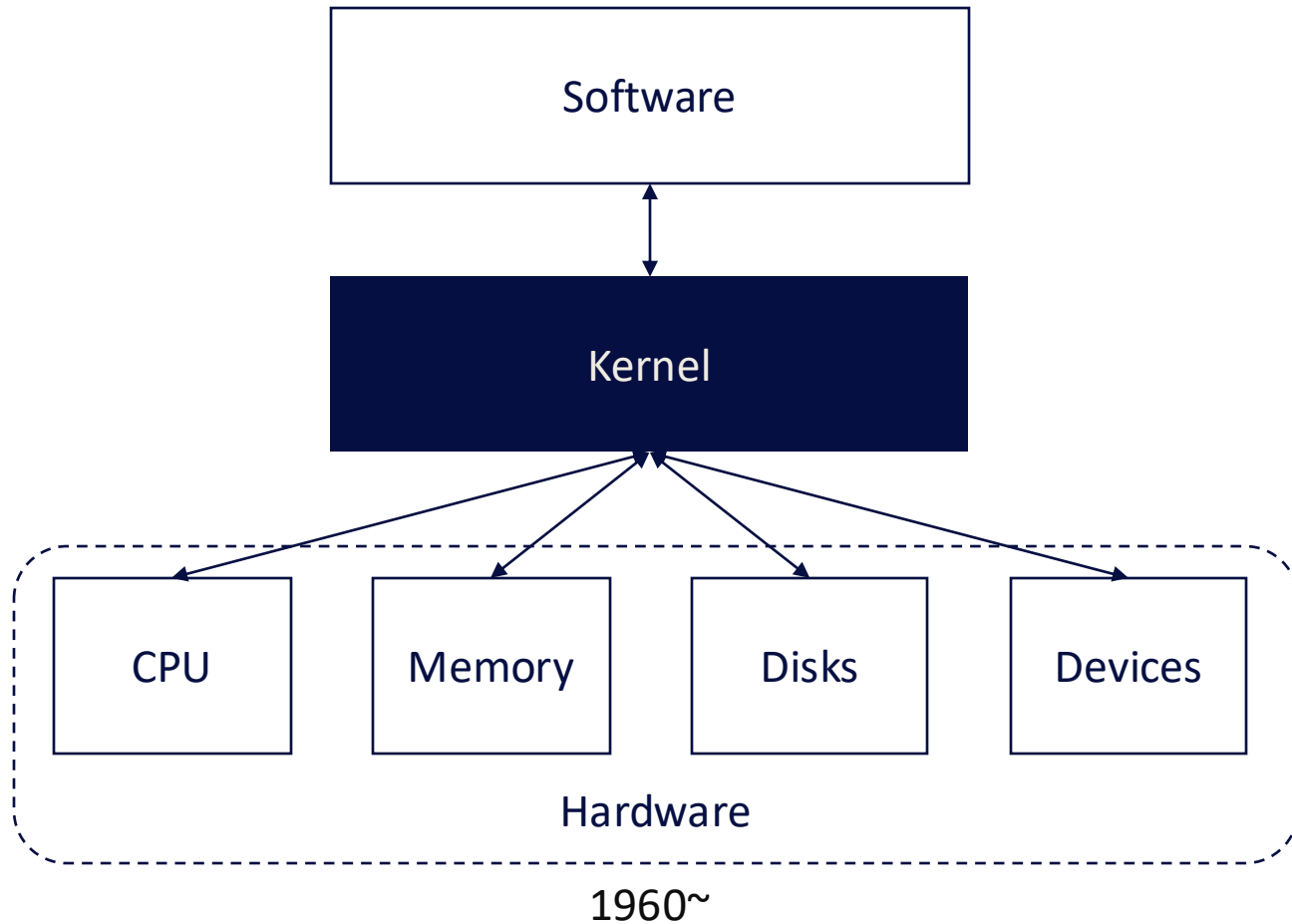
High

Life will be much easier!



The Role of Large Language Model

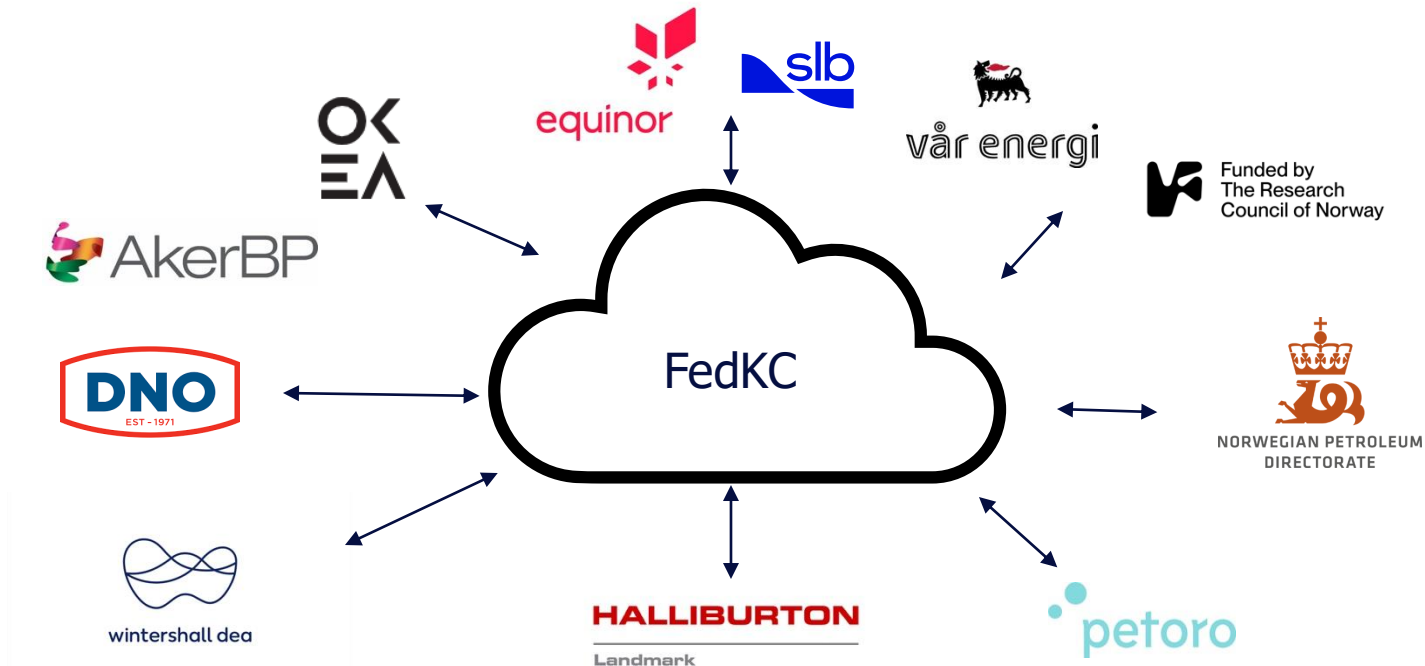
The Role of LLM



Why is LLM important for FedKC?

○ To optimize collaboration and streamline efforts

- You just develop however you want.
- LLM will find the way to use it.



What is missing now?

Federated Knowledge Cloud

?

Large Language Model



Blockchain

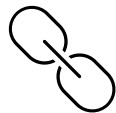
(Access Control, Digital Asset Management, Incentive)

Conclusion

Federated Knowledge Cloud 2025

Domain Knowledge
(insight, code, data, model..)

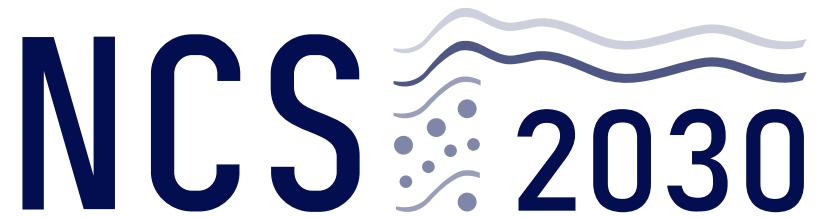
Large Language Model



Blockchain
(Access Control, Digital Asset Management, Incentive)

Thank You!

See you at the stand!



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User partners & observers

