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➢ Background

Problem: When we face diverse tasks and agents, how can we allocate the tasks to suitable agents, so that they can be completed with high quality and at low cost?

Challenges of a centralized planner

- Each agent possesses **partial knowledge** about itself, such as its own capability and previous performance.
- Current LLMs have **limited global planning capabilities**, especially as the number of agents and tasks scales up.

> "Fundamentally, in a system in which the knowledge of the relevant facts is dispersed among many people, **prices** can act to coordinate the separate actions of different people."
>
> Friedrich Hayek

Solution: We propose a `Decentralized Market of Labor Agents`, aiming to reduce the reasoning burden on a single planner and making better use of dispersed knowledge.

- Bids act as information signals: encode advantage (bid for which tasks) and cost (at which prices).

Patent System   **Task Market**   **Labor Agent**
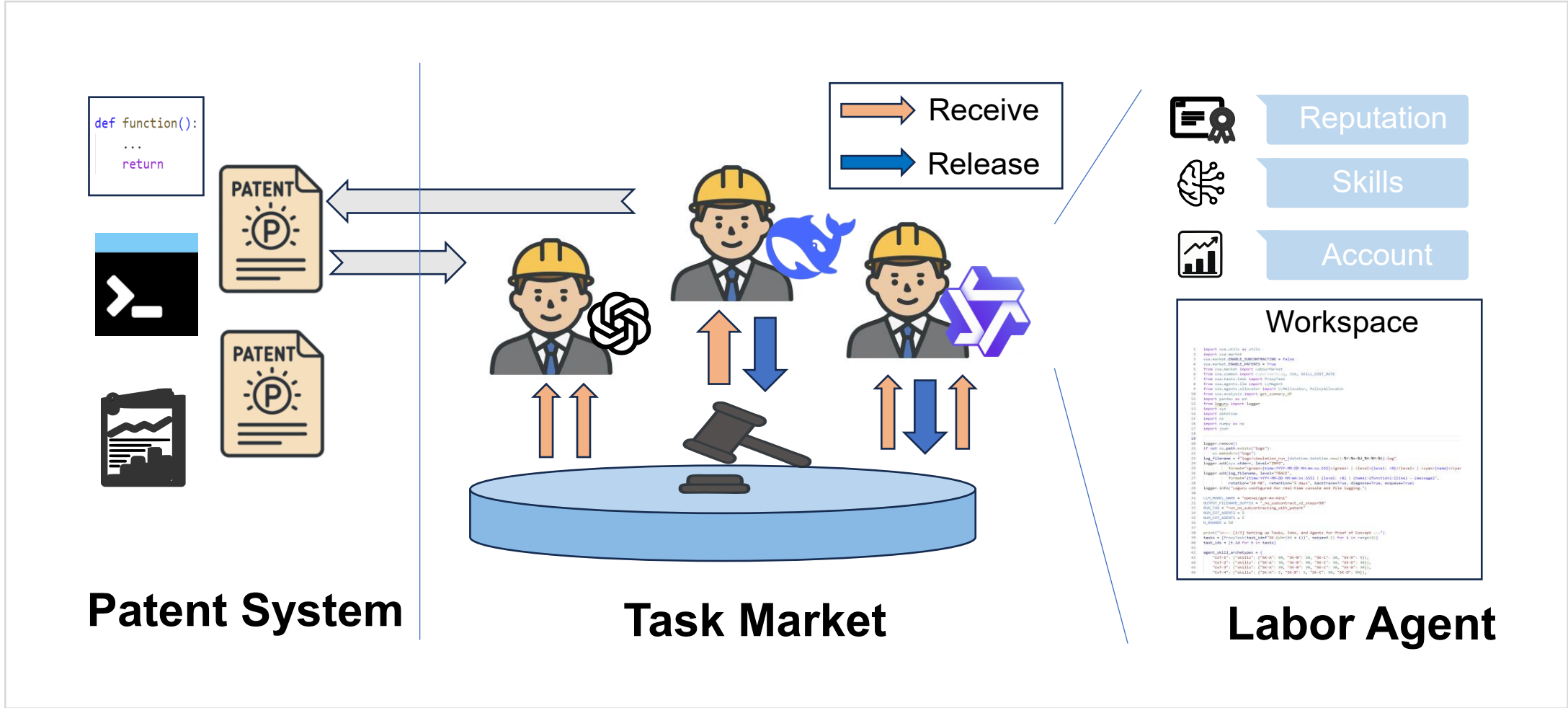
➢ Design

Decentralized Allocation

- Jobs are not assigned by a central brain but by **job-specific LLM Allocators**.
- Allocators select winners by balancing **Bid Price and Reputation History.**

Subcontracting System (Task Decomposition)

- Agents act as **Project Managers**. Upon winning a job, they perform a **Make-or-Buy analysis**: decompose tasks and tender subtasks to the market, optimizing their own risk and profit margins.
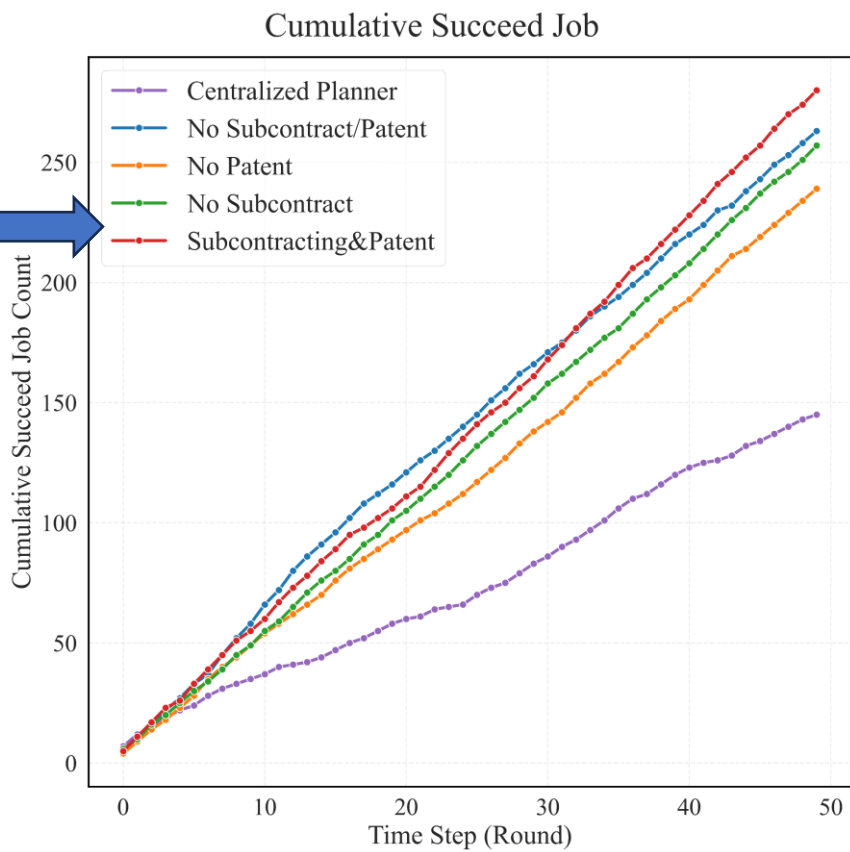
Patent Mechanism (Knowledge Reuse)

- **Publish a patent**: When an agent successfully completes a task, it may choose to publish a patent and set a licensing price.
- **Purchase a patent license**: When an agent wins a task bid, it gains access to patents relevant to the task and may decide whether to purchase a one-time patent license.

## ➢ Simulation Results (Stay Tunned for Real Tasks!)

Market Efficiency
The **Decentralized Market** (with Subcontracting & Patents) achieves a higher cumulative success rate than the **Centralized Planner baseline**, proving that price signals effectively handle dispersed information.

Cost Optimization
The **Patent Mechanism** significantly reduces the total market execution cost. Agents leverage purchased knowledge (patents) to solve difficult tasks more efficiently than attempting them from scratch.
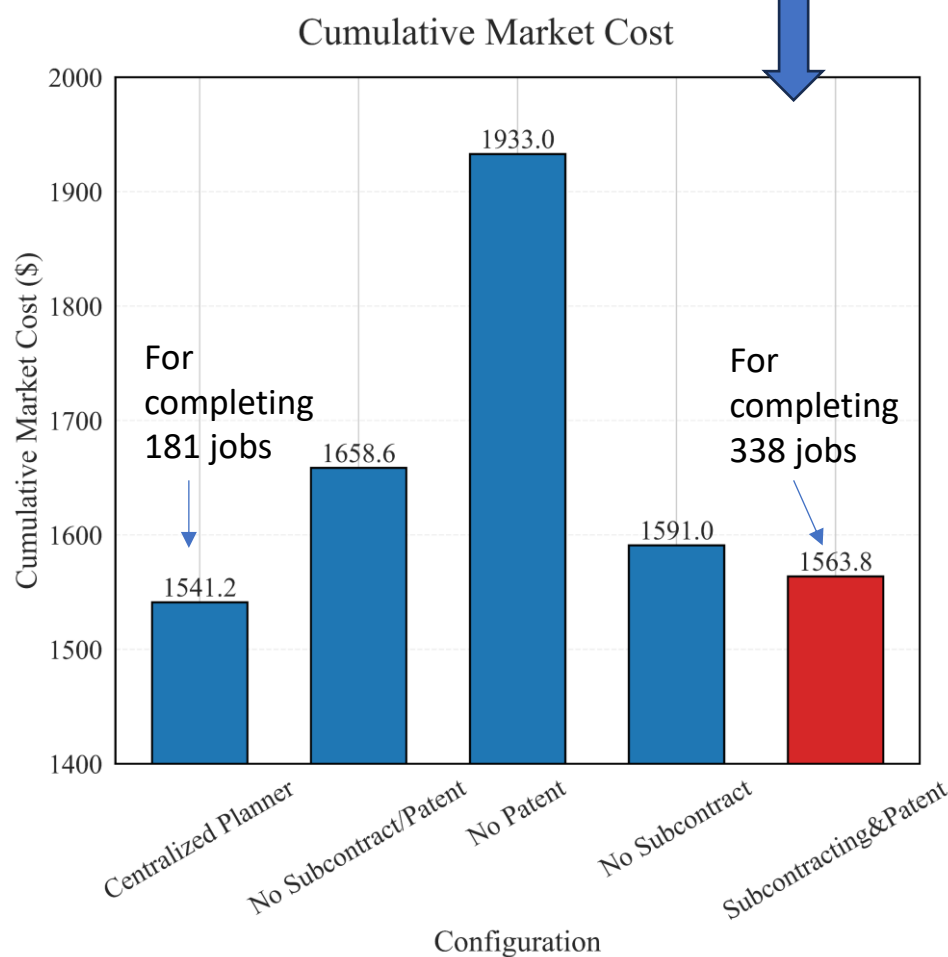
Emergent Specialization
Agent rewards diverge based on types. Specialists (e.g., Skill-CD Dual Specialist) accumulate wealth faster, indicating the market correctly incentivizes skill alignment and specialization.