

Semantic-aware LLM- Application Scheduling

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December 10, 2025

Introduction

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- It's expensive!

Utilising LLM Applications

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Hard to productionize

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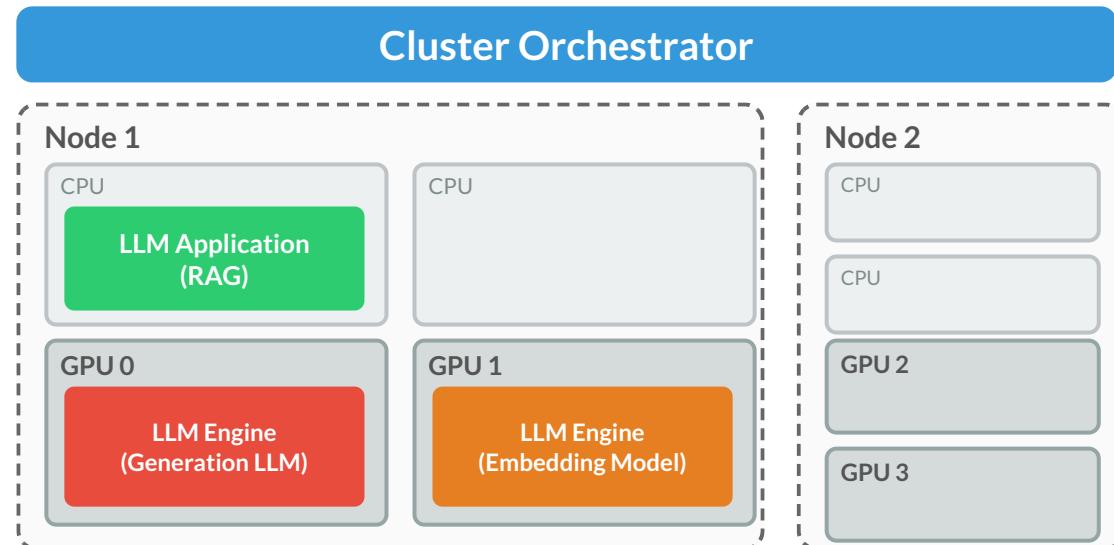
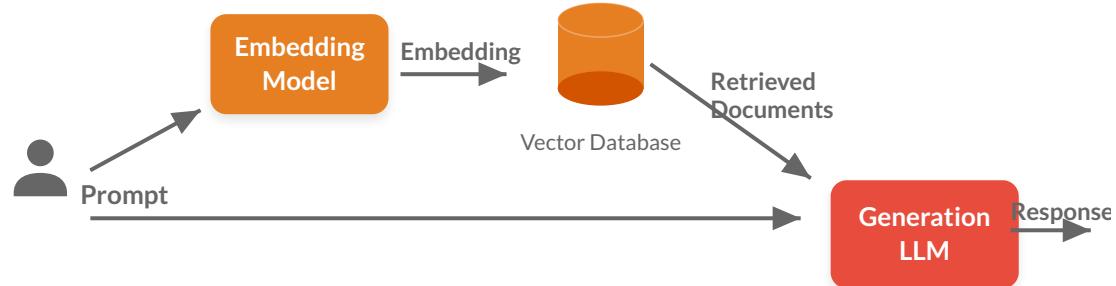
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Infeasible for companies at smaller scale to achieve efficient deployments applications. They need automated solutions.

LLMs → LLM Applications

- LLM Invocations -> Graphs
- Can't optimise for end-to-end performance
- Lack of Critical Path Awareness
- Unfairness



Related Work

| System | Level | Multi-Engine | Application-Aware | Scheduling Granularity /Co-location |
|--------|-------|--------------|-------------------|-------------------------------------|
| | | | | |
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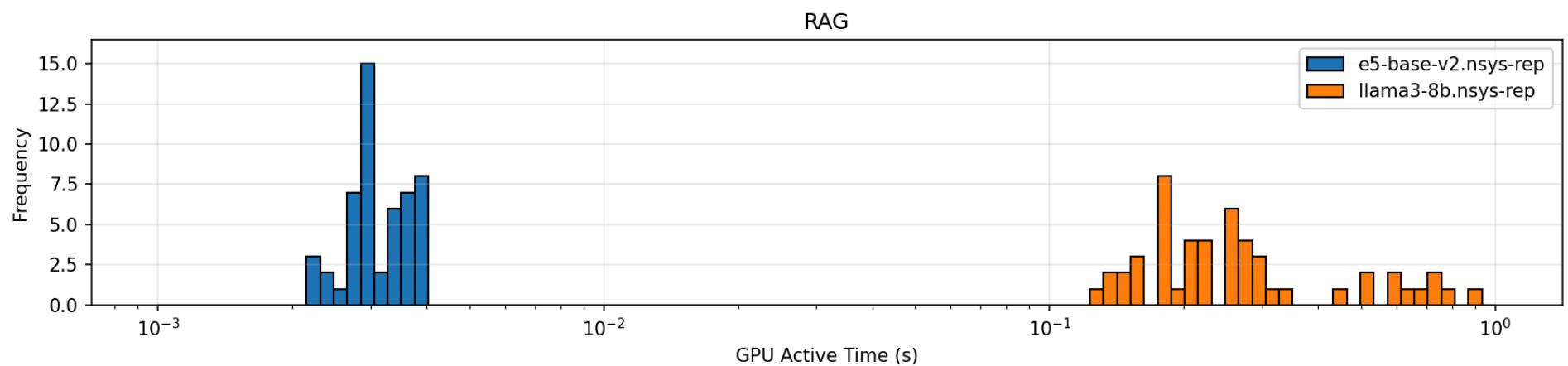
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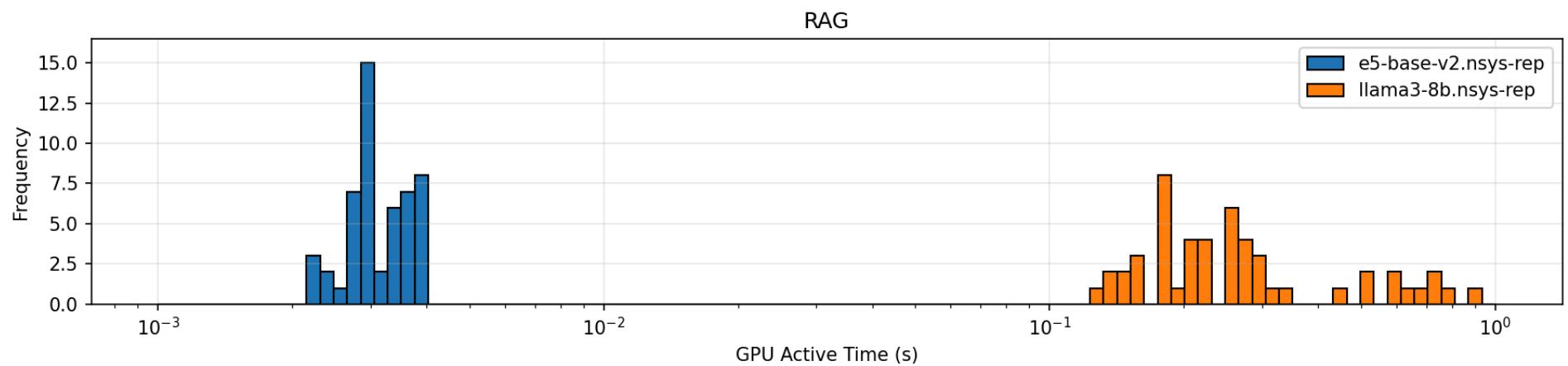
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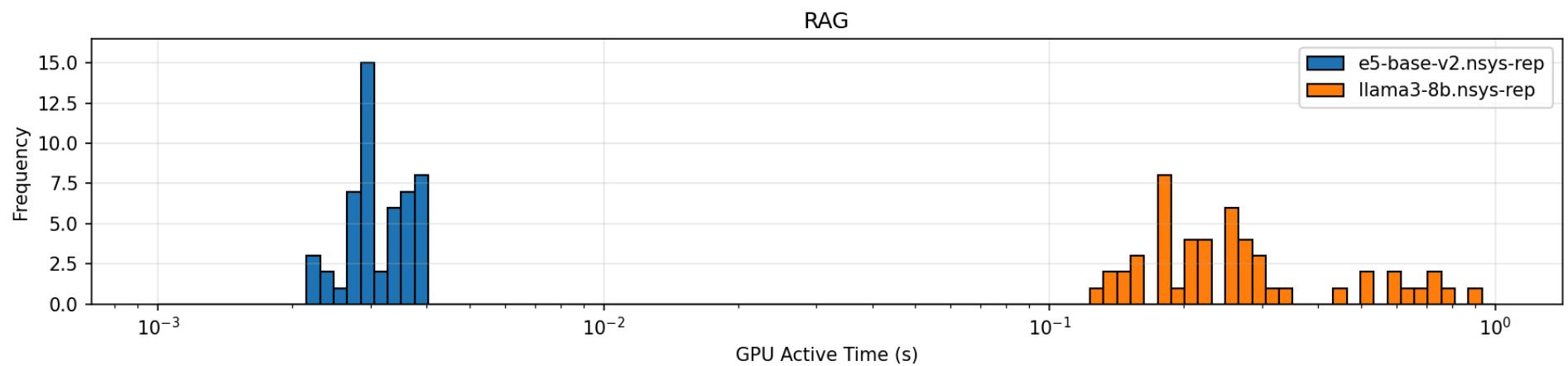
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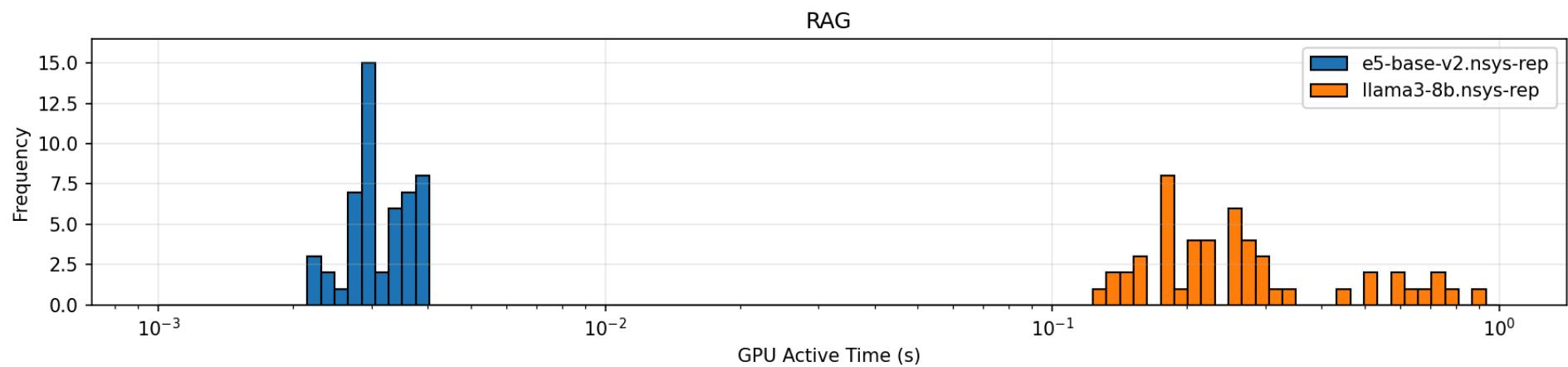
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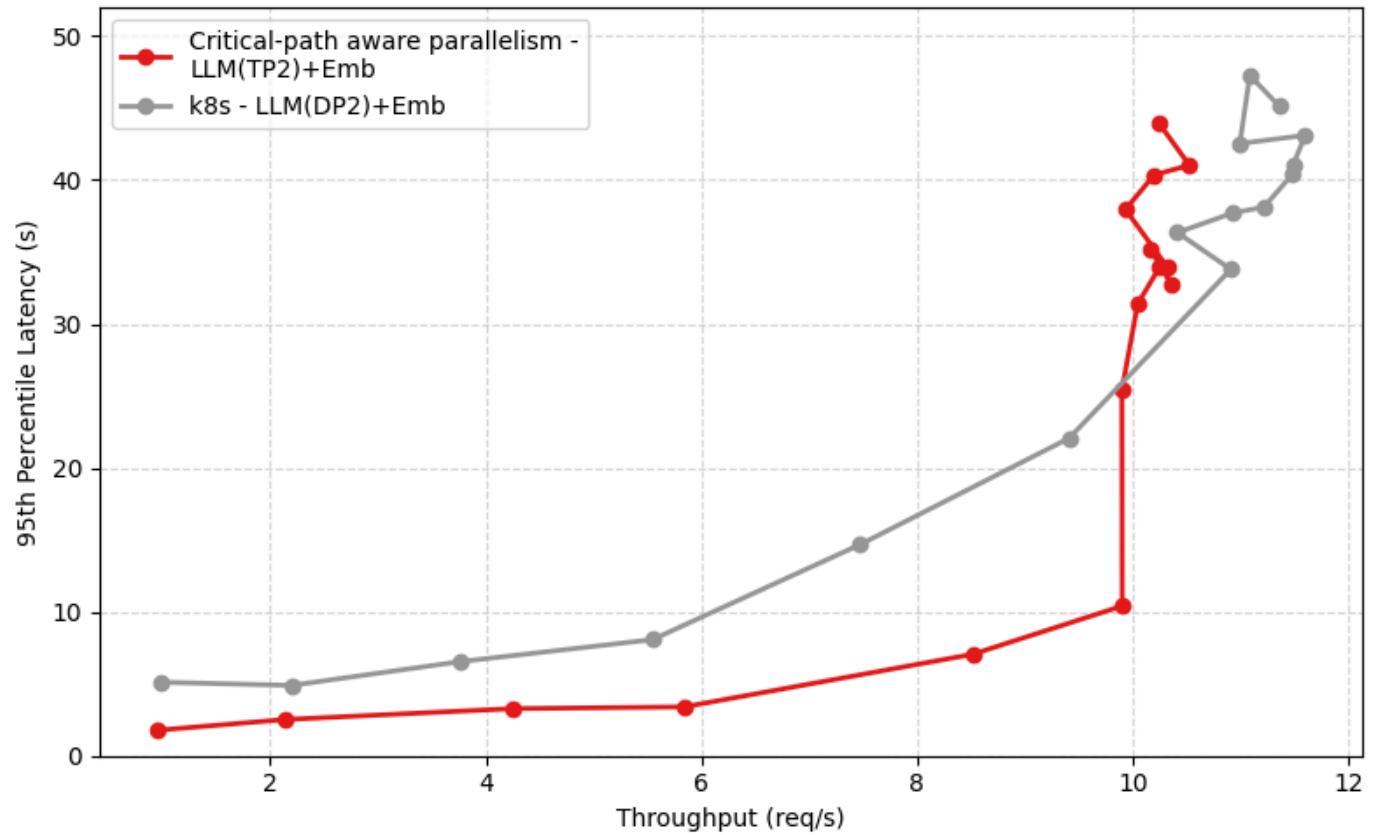
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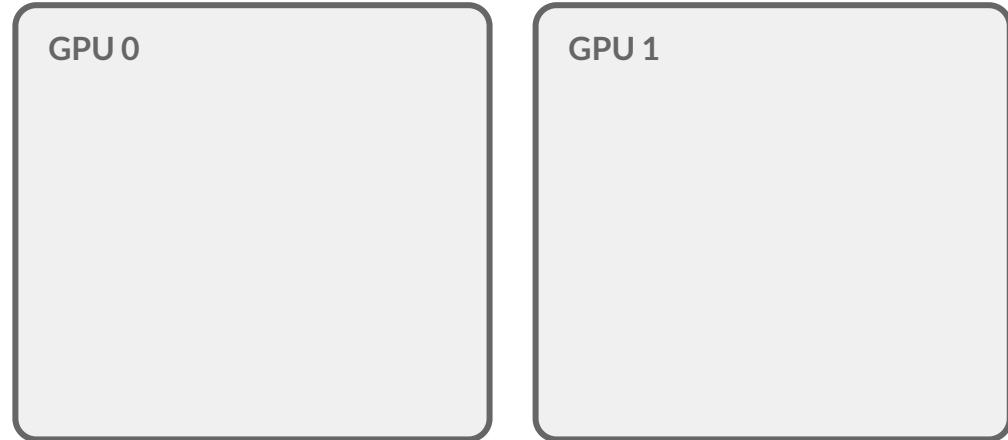
- LLM latency 100x embedding latency
- LLM is the critical path
- TP2 halves RAG application latency

Critical-path Aware Parallelism

- 2.4x improvement in latency
- Minor degradation in throughput

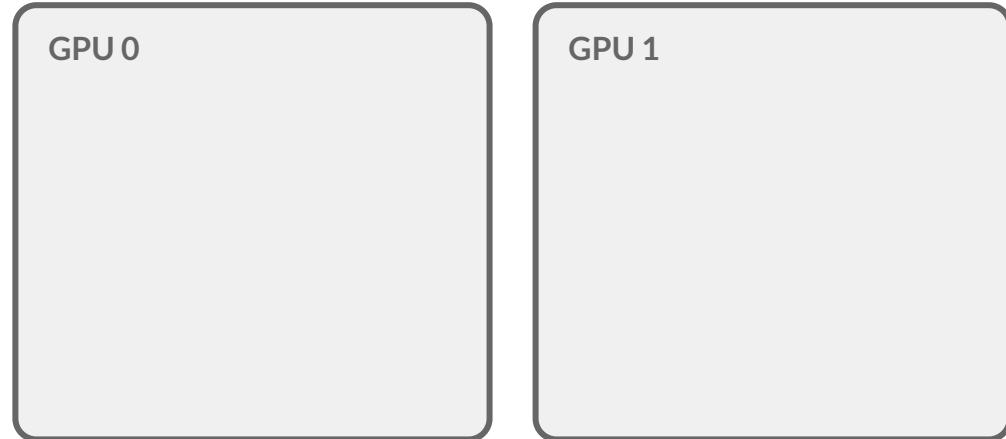


Critical-path Aware Co-location



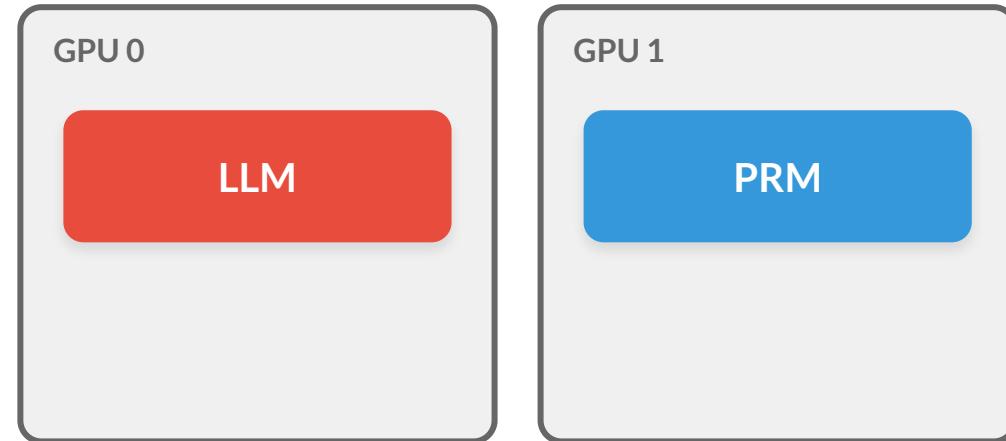
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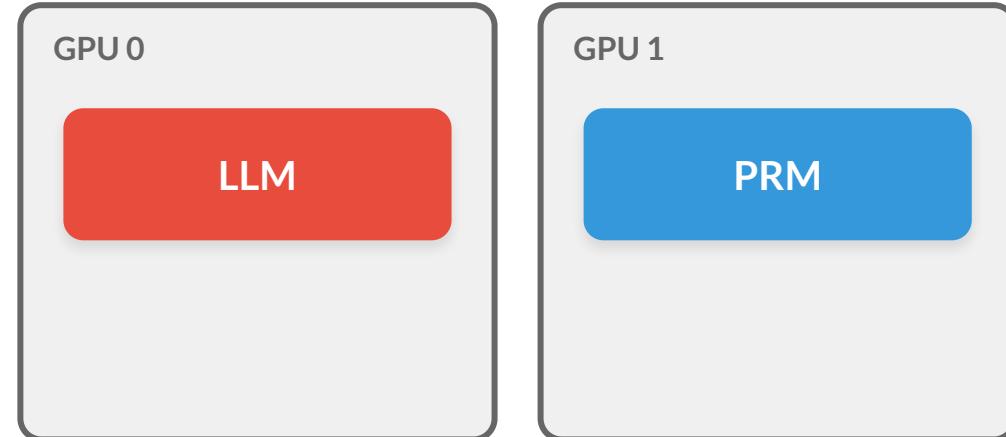
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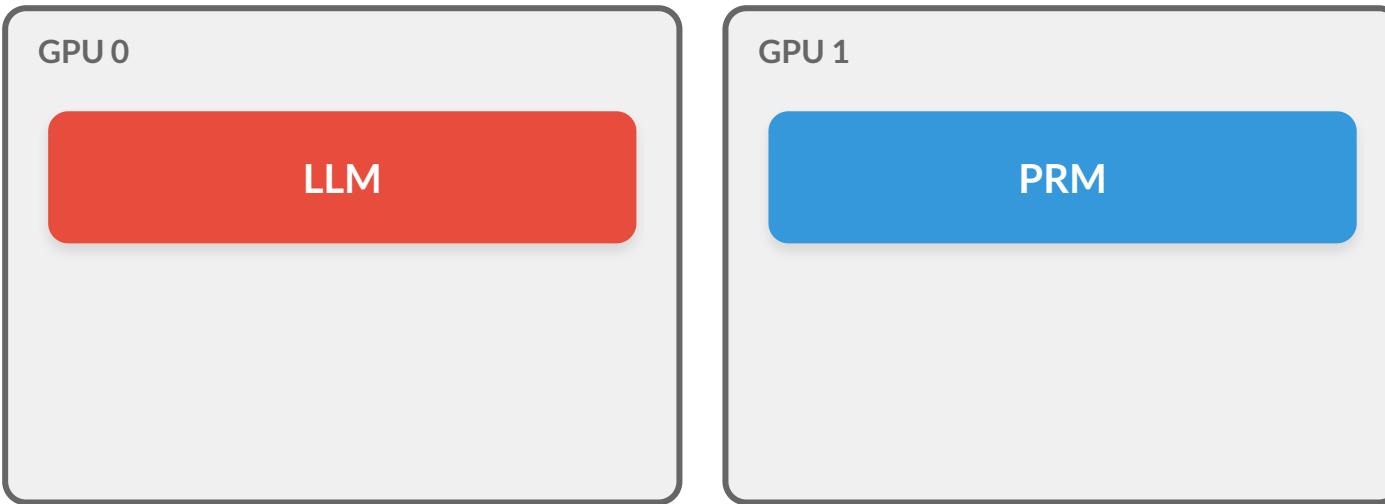


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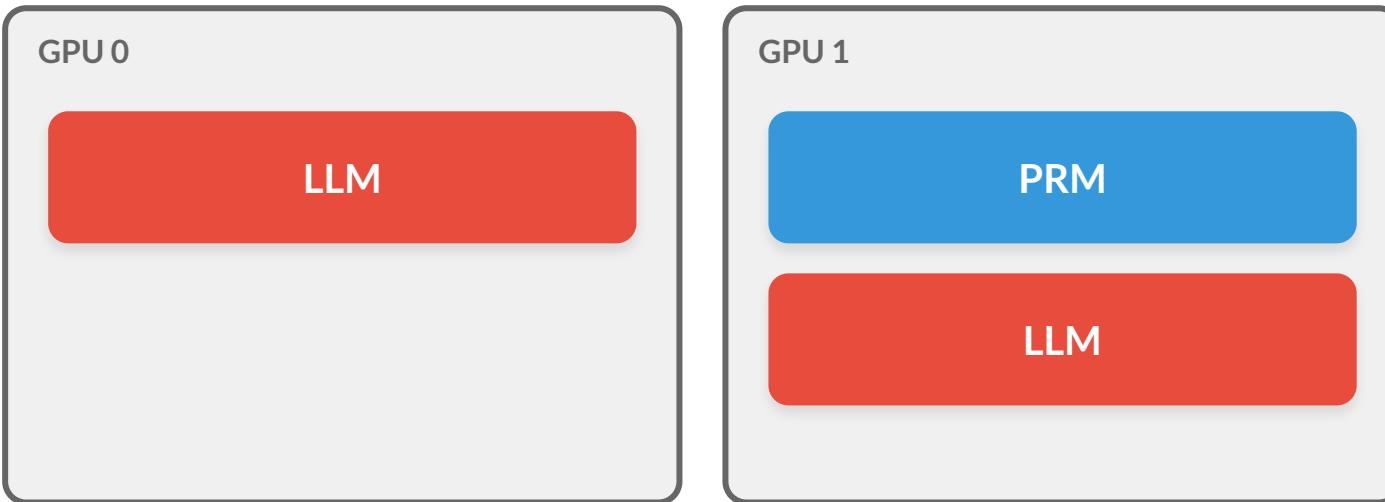
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- Severe underutilization



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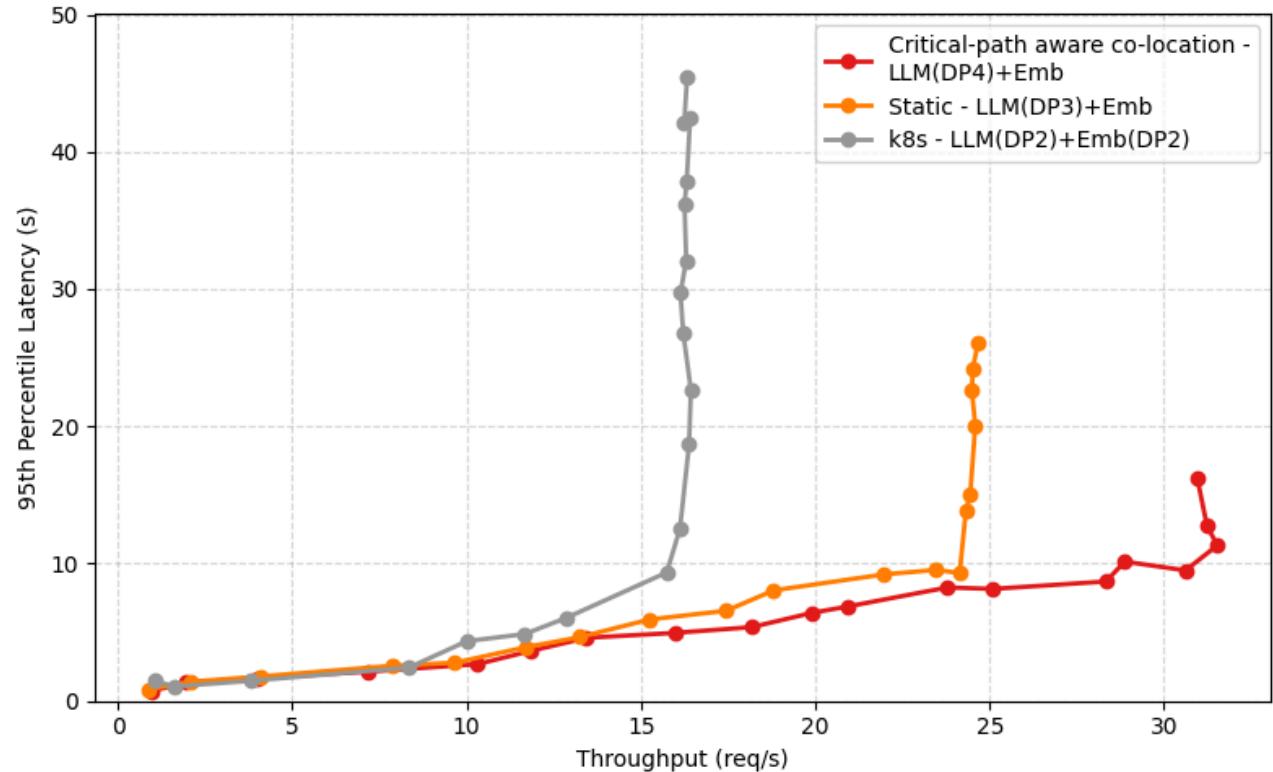


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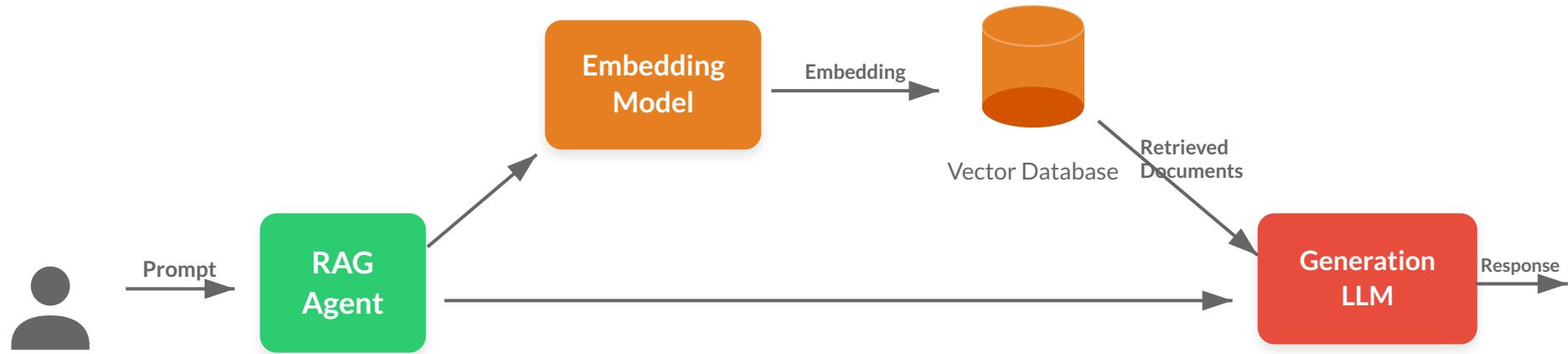


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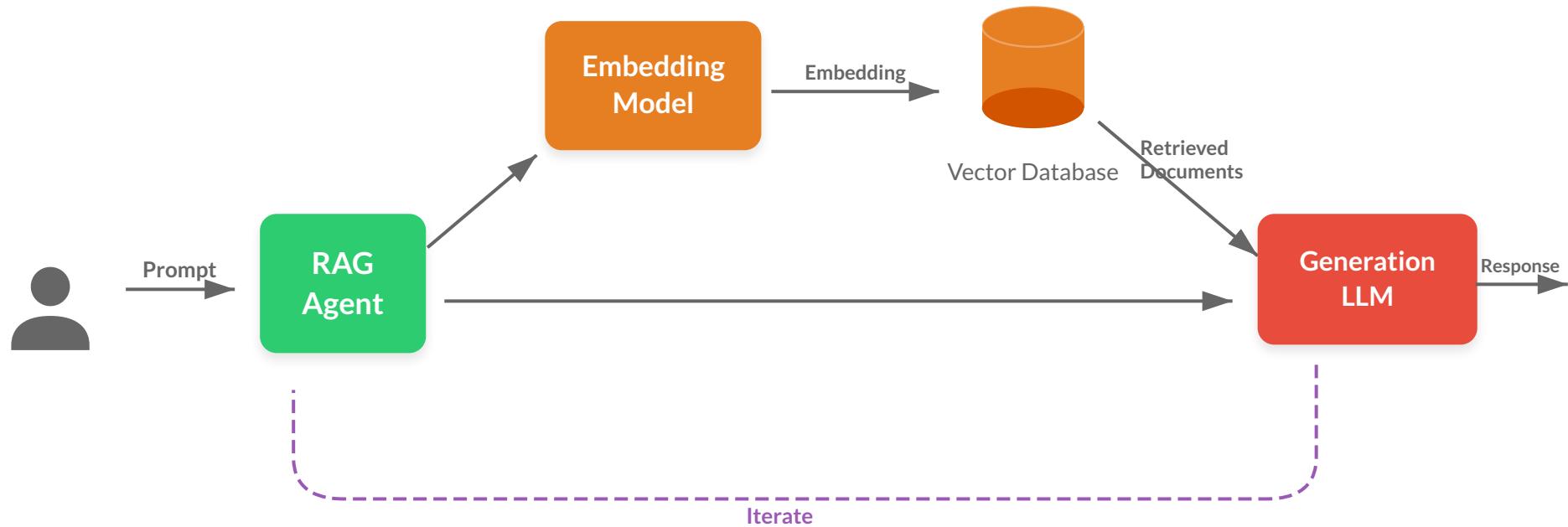
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- 50% over best manual K8S config
- K8S: data parallelism only



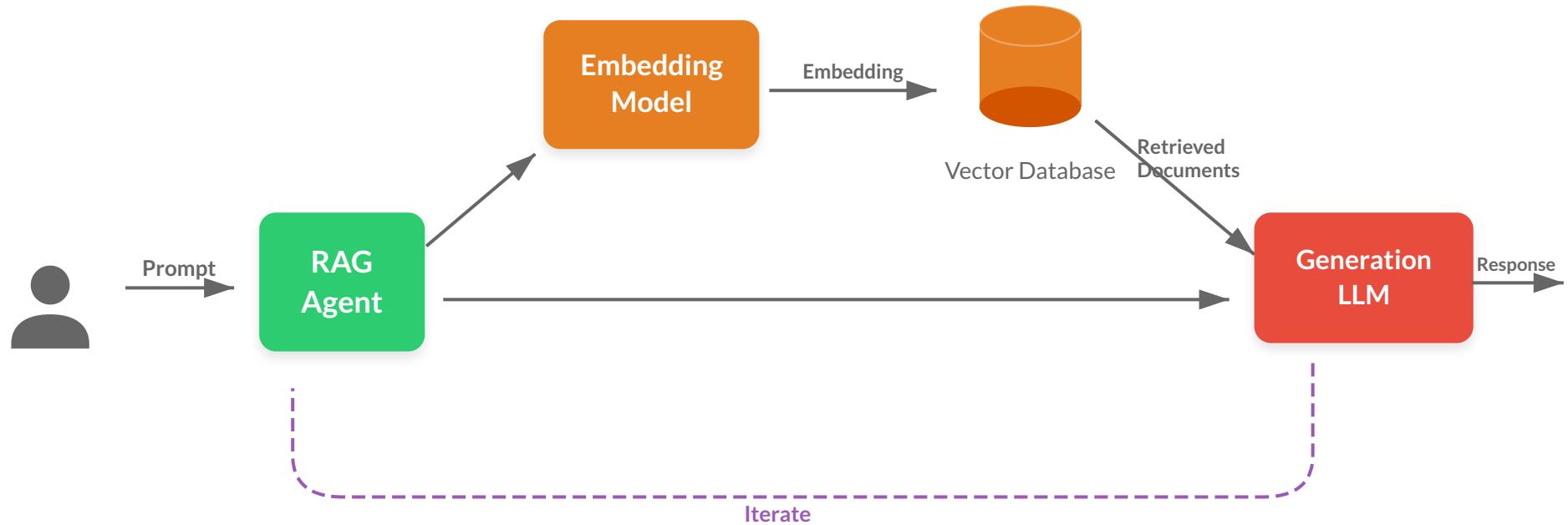
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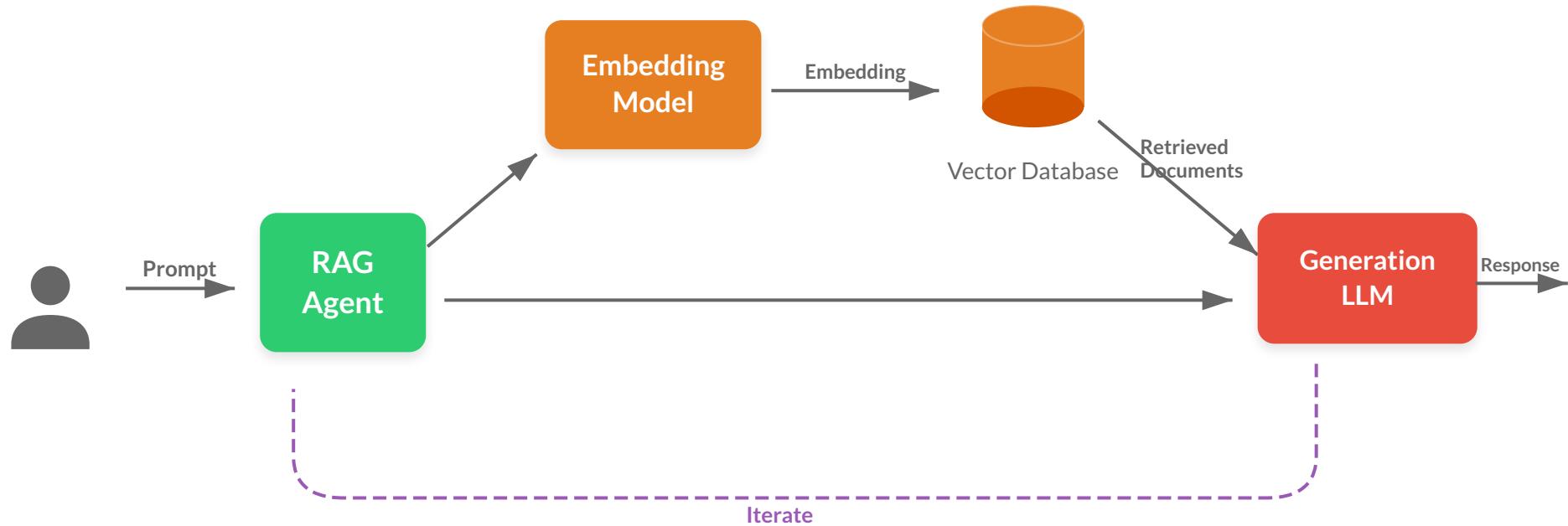


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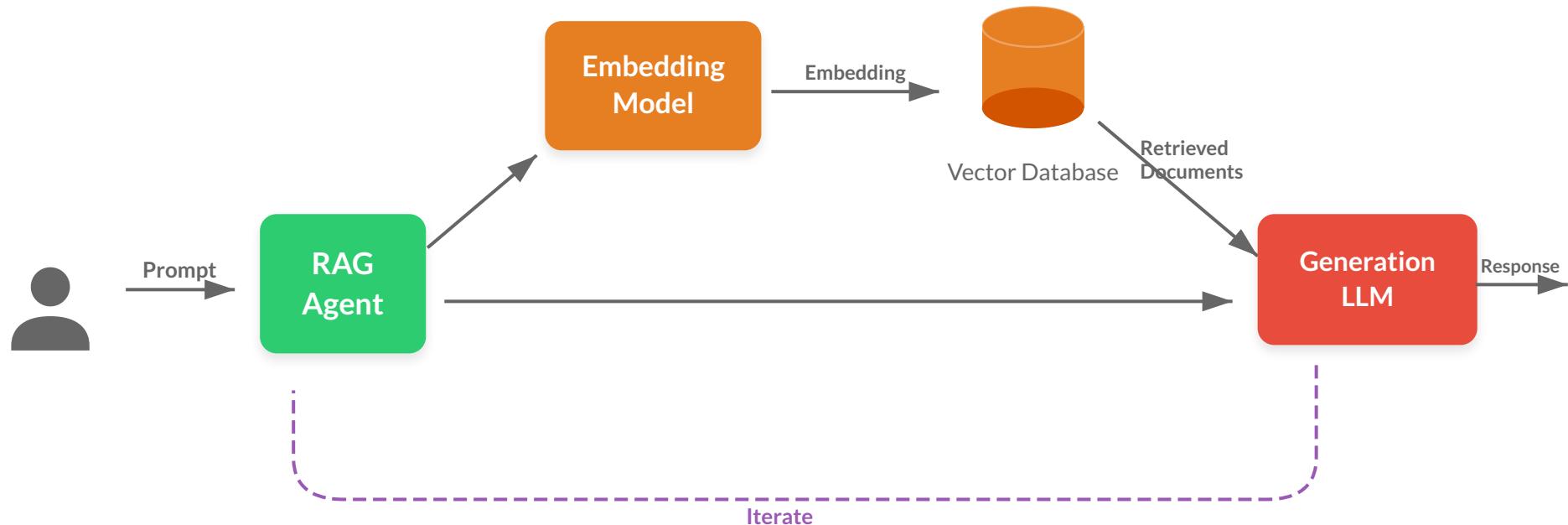
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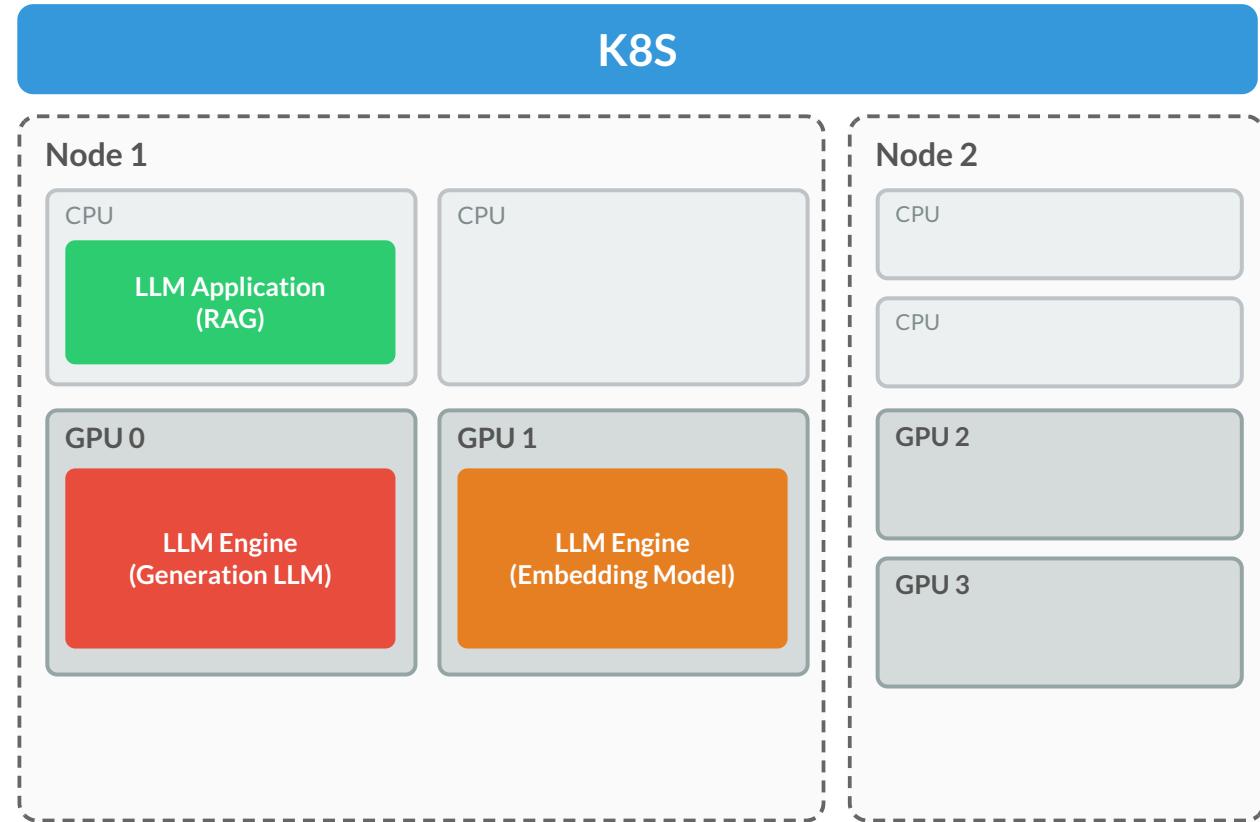
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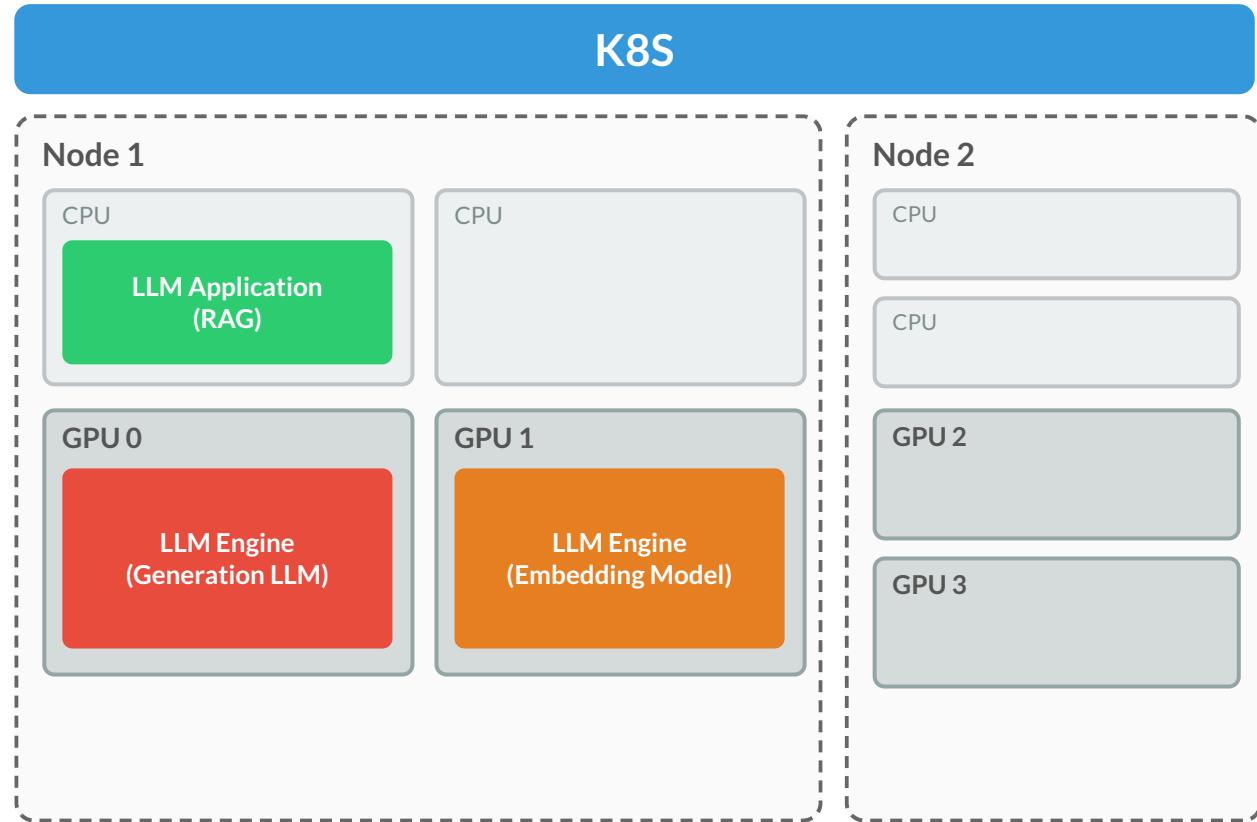
- Common pattern in agentic applications
- Some requests far more expensive than others
- HoL blocking for the many cheaper requests that iterate fewer times

Future work: Multi-Engine Fairness



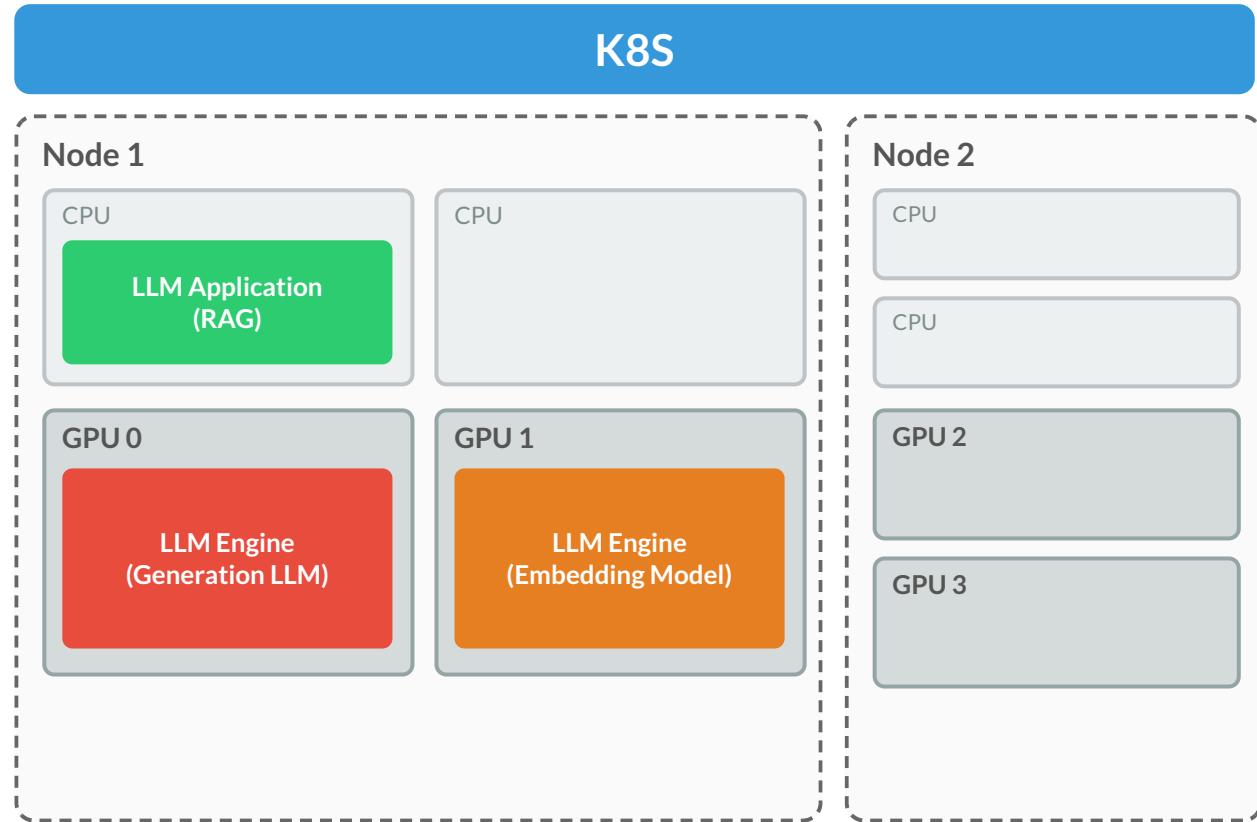
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- Applications can span multiple engines
- Can also have HoL blocking between workflows

