Span Queries: a Declarative Map/Reduce Approach to Scale-up and Scale-out Inferencing

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What if we had a SQL for GenAI?

SQL

- SQL lets apps prepare the backend for future queries
- SQL lets apps separate concerns of imperative app logic and declarative data logic
- SQL lets app express bulk analytical queries

How can we apply this to GenAI?

- Map/Reduce
- Spans
- Dependent/independent sub-sequences

A Span Query is an expression tree over g, x, +

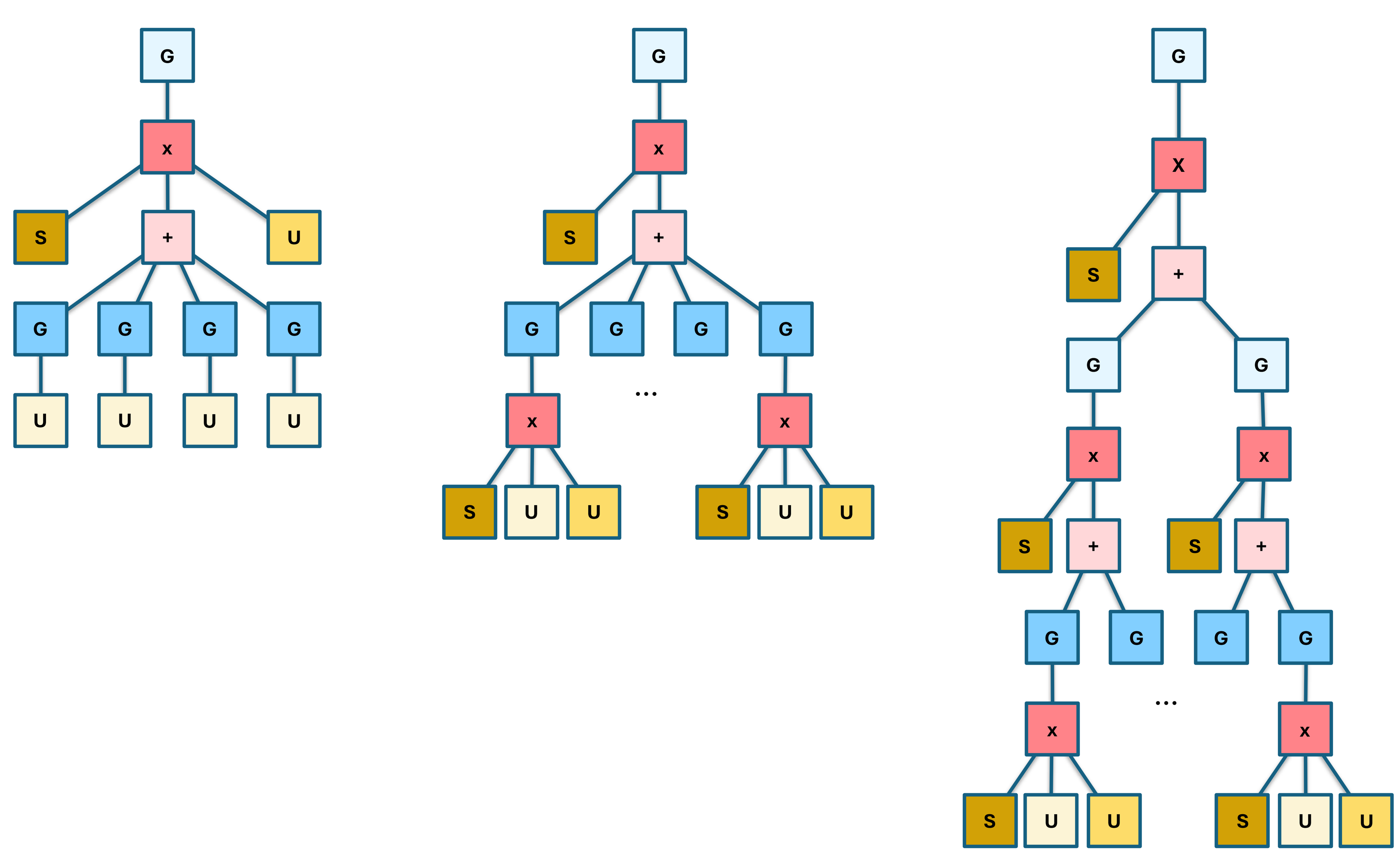
g: generate	**x**: depends-on/attend-to	**+**: independent

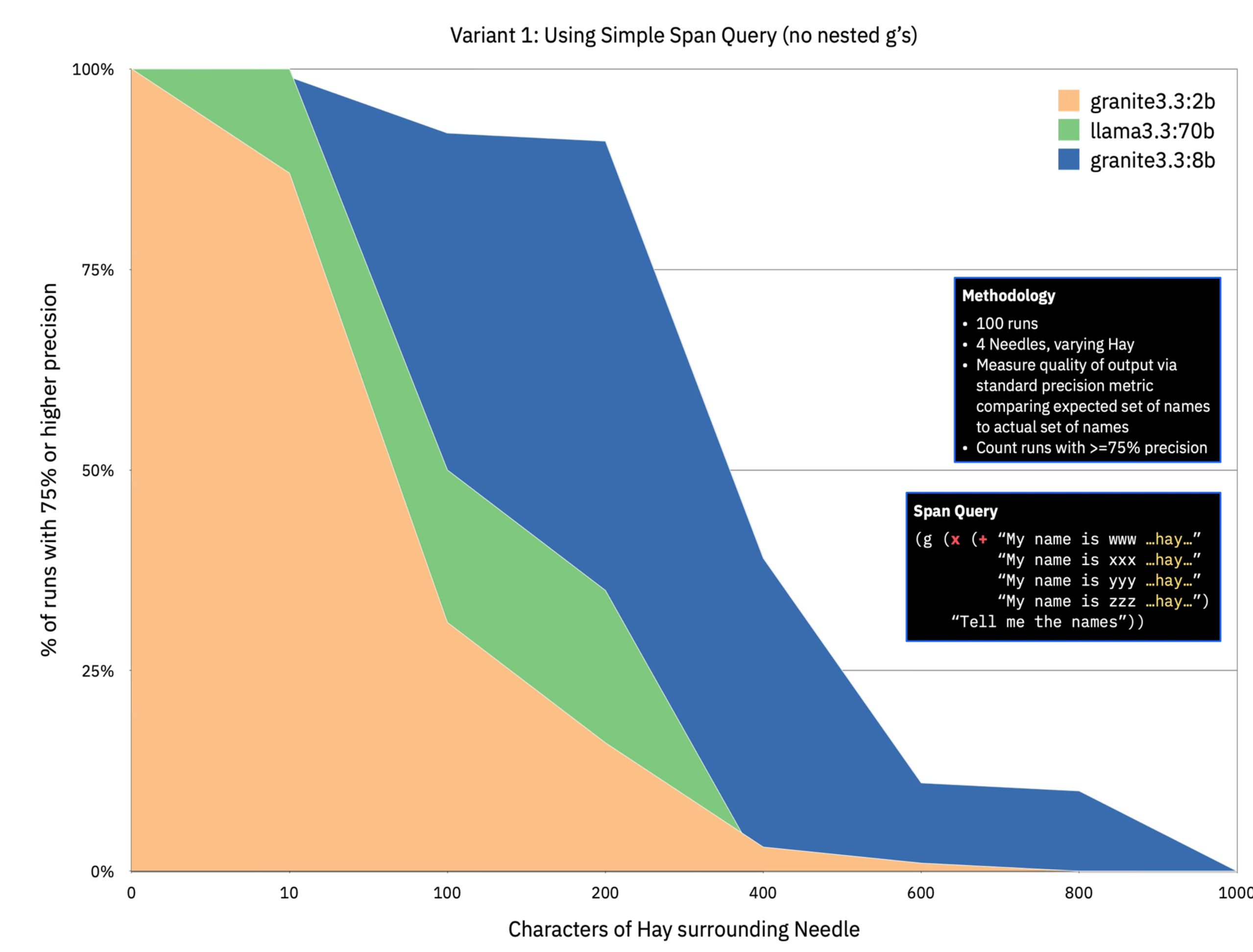
Textual Representation *(note: not proposing as DSL)*

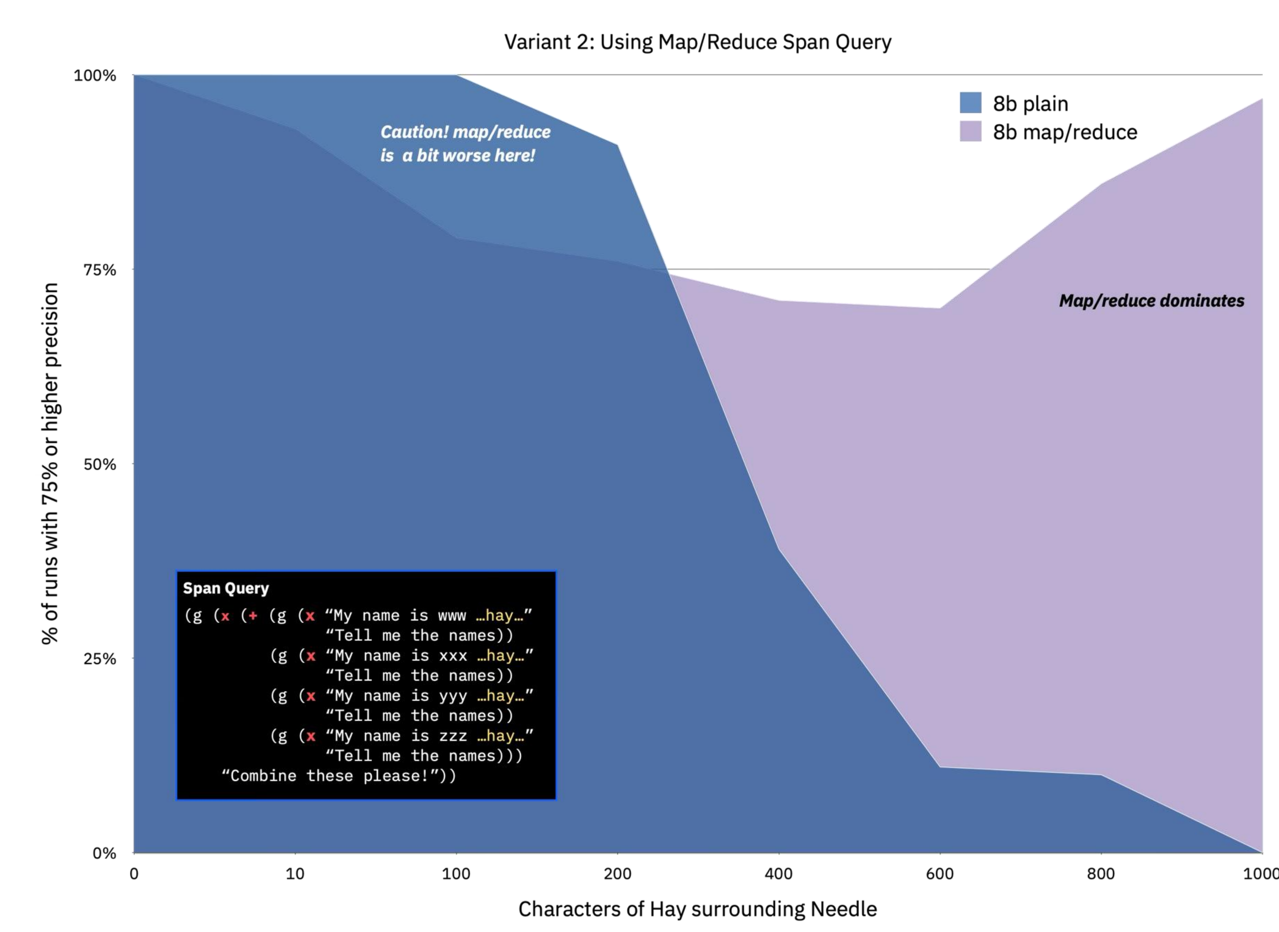
```
(g (x (system "A good email is…")
    (+ (g (user "an introductory email"))
       (g (user "an introductory email"))
       (g (user "an introductory email"))
       (g (user "an introductory email"))
    (user "I am applying to IBM")))
```

Tree representation

As written | *Unroll and jam* | *Log2 reduce*

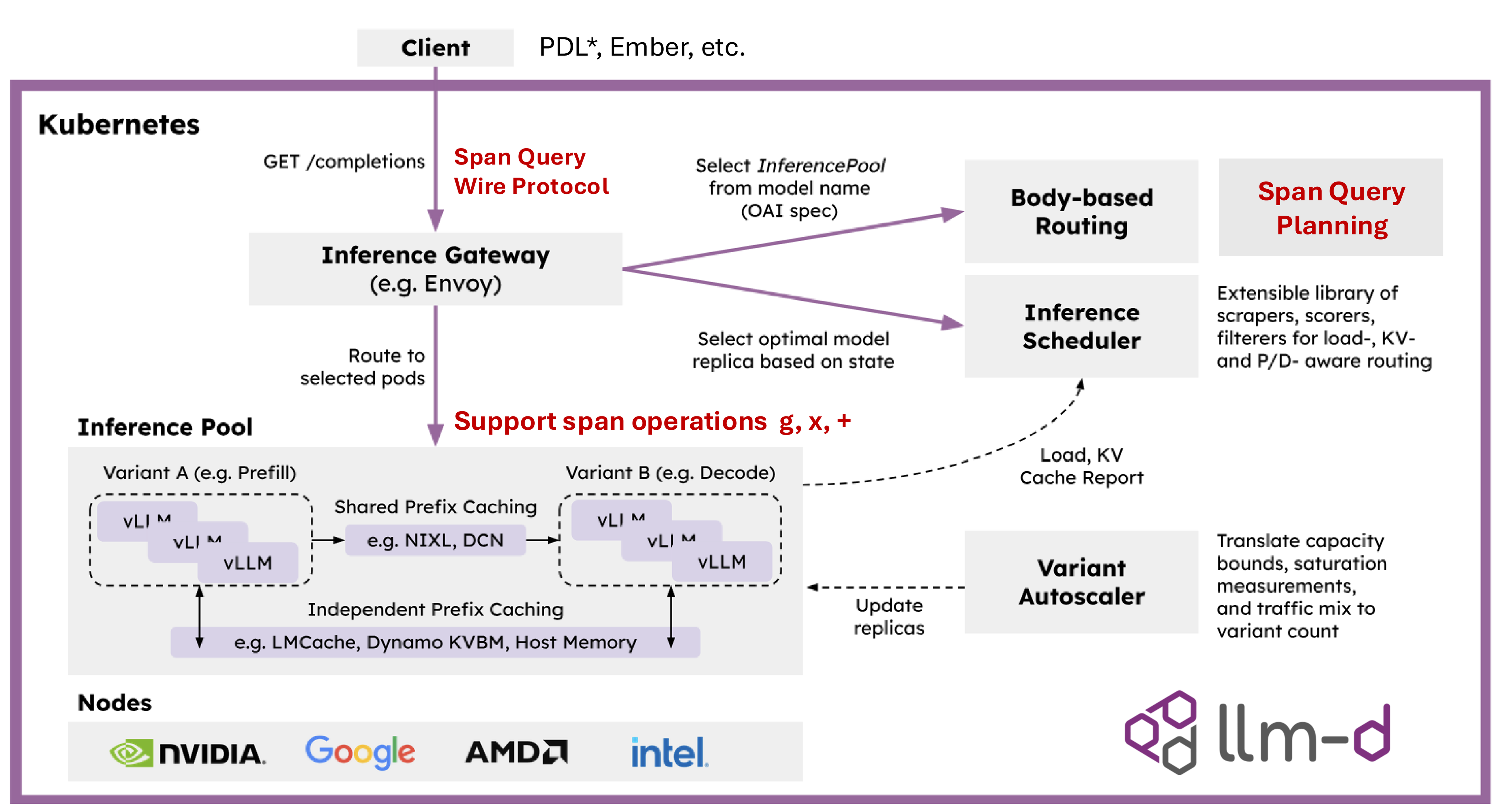






Strike Points Across the Stack

1. How can **vLLM scale-up** better when given the dependence relations implicit in a span query?
2. How can **llm-d scale-out** better in light of a map/reduce query structure?
3. Does the backend benefit from "**prepared statements** I.e. being given, in advance, templated queries?
4. Can we **simplify client libraries** by leveraging a SQL-like separation of concerns?
5. Can we **consolidate inference scaling patterns** aroun queries? How many of them can be expressed as queries?



*could be span query client syntax

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