Telecom Question Answering Systems

LLMs and the Future of Semantic Interoperability

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Enterprise Question Answering (QA) systems demand semantic interoperability—not just between **heterogeneous knowledge stores** (structured, semi-structured, and unstructured), but also across the **communication layers** between **customers and agents**.

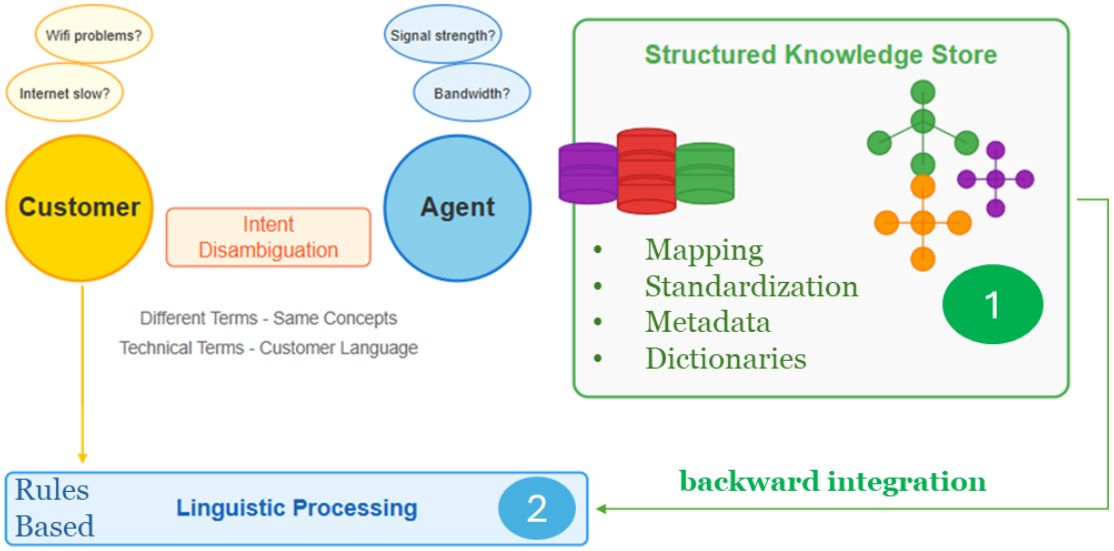
Enterprise Question Answering (EQA) : State of Art

1. Linked Data Principles

- Bridging disconnected knowledge systems and data models
- Harmonizing diverse information architectures across the enterprise
- Enabling cross-functional data accessibility and utilization

2. Customer Query Disambiguation

- Translating natural language inquiries into structured data queries
- Aligning customer intent with enterprise knowledge assets
- Providing contextually relevant responses to varied customer needs



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State of Art

Given Linked Data, user query disambiguation and inferencing is a solved problem.

[**Capabilities - Intra-Graph Query Resolution**]

Gaps

Given any diverse query, integrating and reasoning across heterogeneous datasets remains a significant challenge.

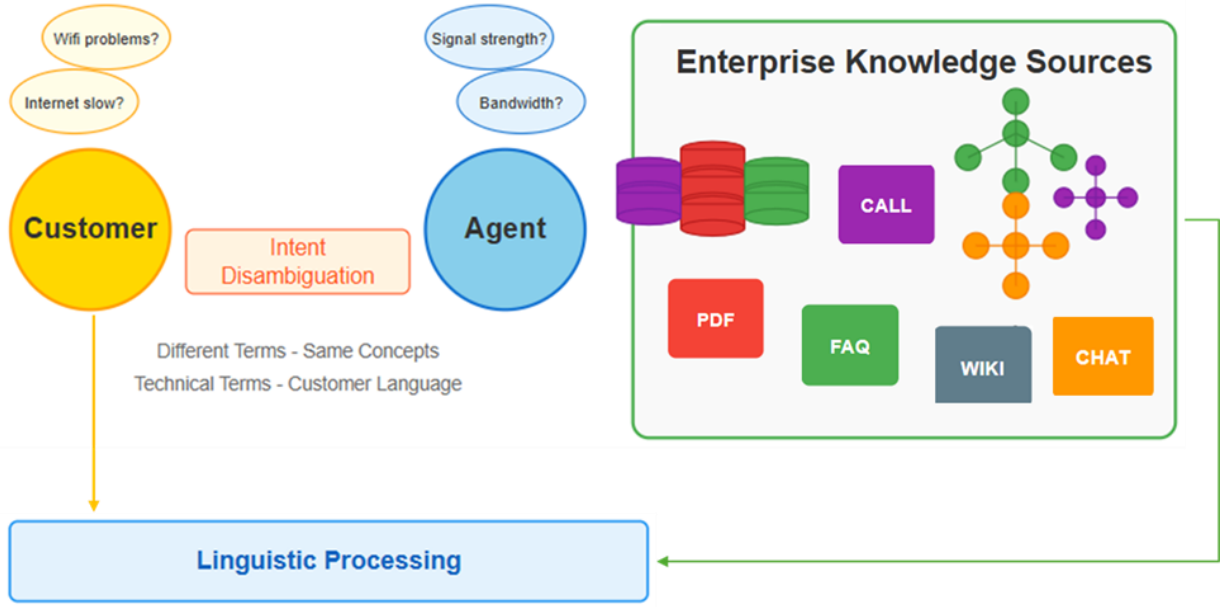
[**Challenge - Federated Query Processing**]

EQA : Unresolved Challenge #1

Enterprise data is largely unstructured, **with 80%** falling into this category.
[Sources : Gartner, IBM, MIT, Forbes]

Semantic Interoperability of Heterogenous Sources?

- Knowledge Engineering
- Standardization , Semantic Integration
- Dynamic updates
- Knowledge Retrieval

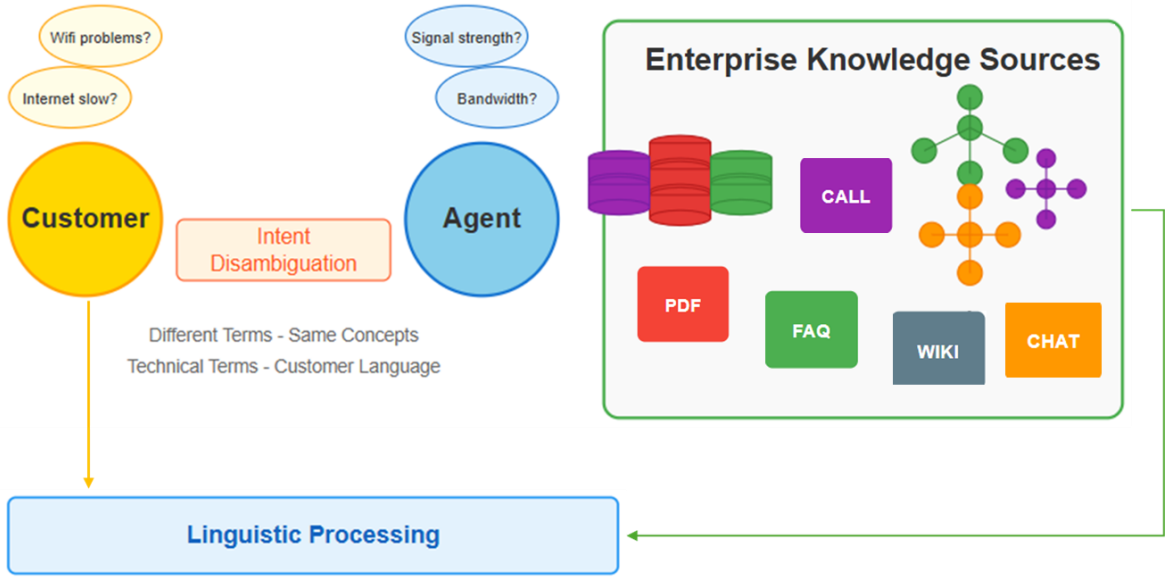


EQA : Unresolved Challenge #2

Language is 'the infinite use of finite means'. *Wilhelm von Humboldt*

Semantic Interoperability for Customer Queries?

- How many rules would we need for query disambiguation?
- Feasibility, Viability of efficient Rules Engine ?



"why is my **internet** speed slow"
"why is my **broadband** slow"
"Videos keep **buffering** on my laptop"

"why is my **download speed** not as per contractual terms"
"my **Wi-Fi** connection is not stable"

LLMs for Unresolved Challenges in EQA?

Semantic Interoperability of Customer Query? (RQ1)

Semantic Interoperability of Heterogenous Sources? (RQ2)

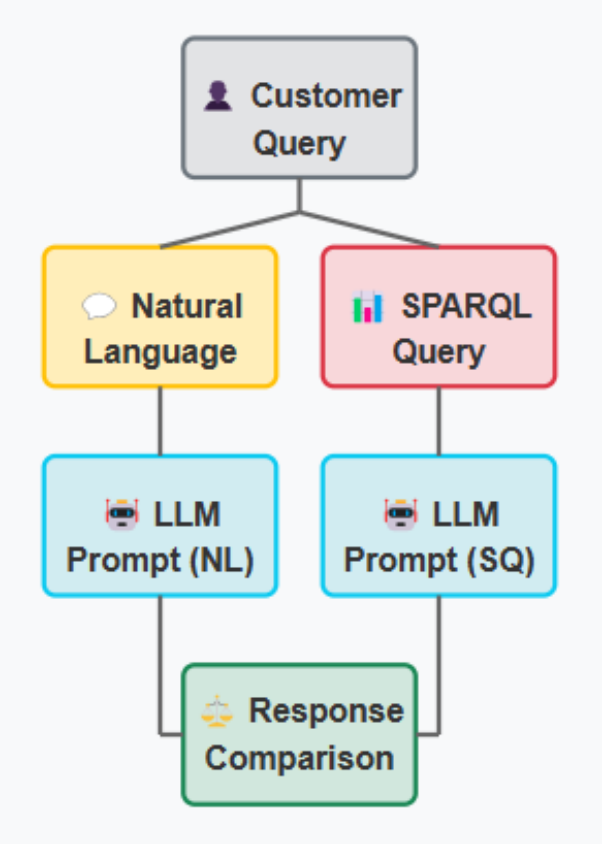
LLMs for Customer Query Disambiguation ?

Methodology

SPARQL based prompts to LLMs instead of Natural Language Prompts

Hypothesis & Expectations

- Structured Query Language mirror the data model for parametric relational knowledge in LLMs
- Latent domain knowledge (technical) accessible through specialised methods
- Self-Attention, Positional Encoding and Conditional Probabilities have bigger impacts from structured queries
- Rules Based disambiguation – not required



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LLMs for Customer Query Disambiguation ?

Methodology

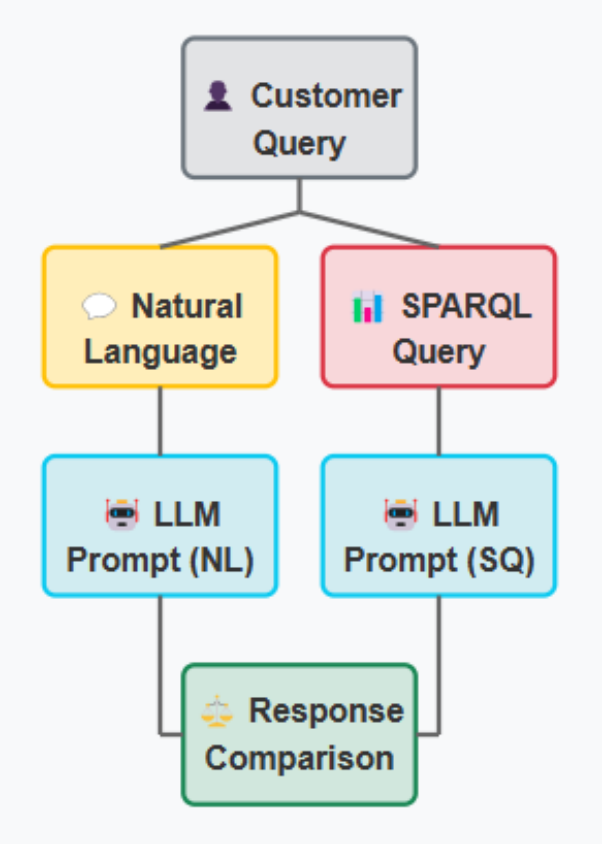
SPARQL based prompts to LLMs vs. Natural Language Prompts

Results

"Can I use an EE tablet for streaming TV on a bigger screen without paying any monthly mobile charges?"

- **Natural Language Prompt –** resolution provided for device setup, hardware, software checks [**Technical**]

- **SPARQL based Prompt** – subscription services, data plans, and the terms of service associated [**Service**]



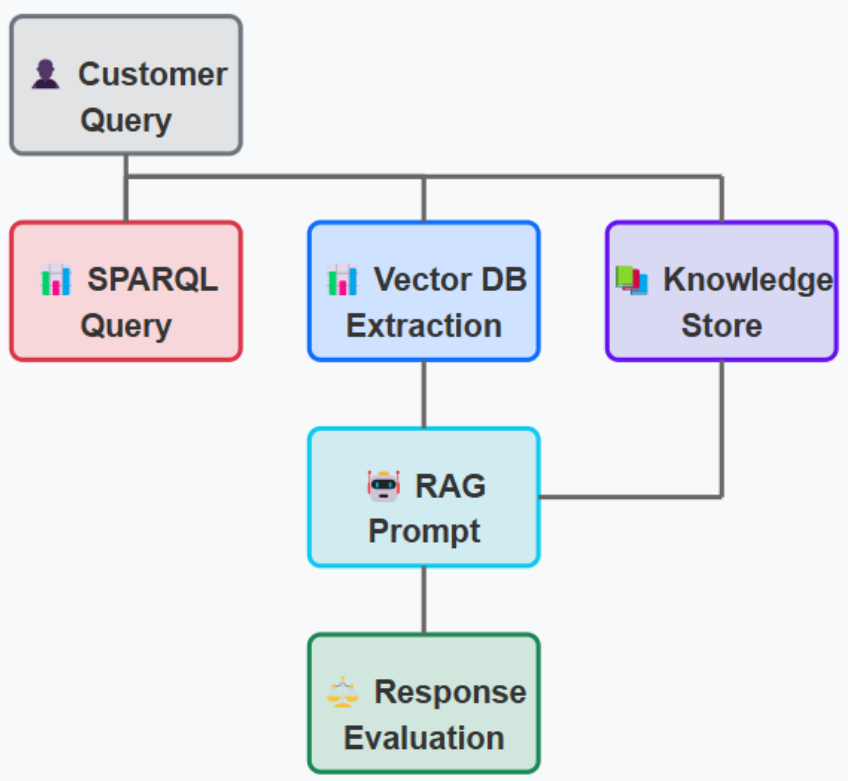
LLMs for Heterogenous Knowledge Integration ?

Methodology

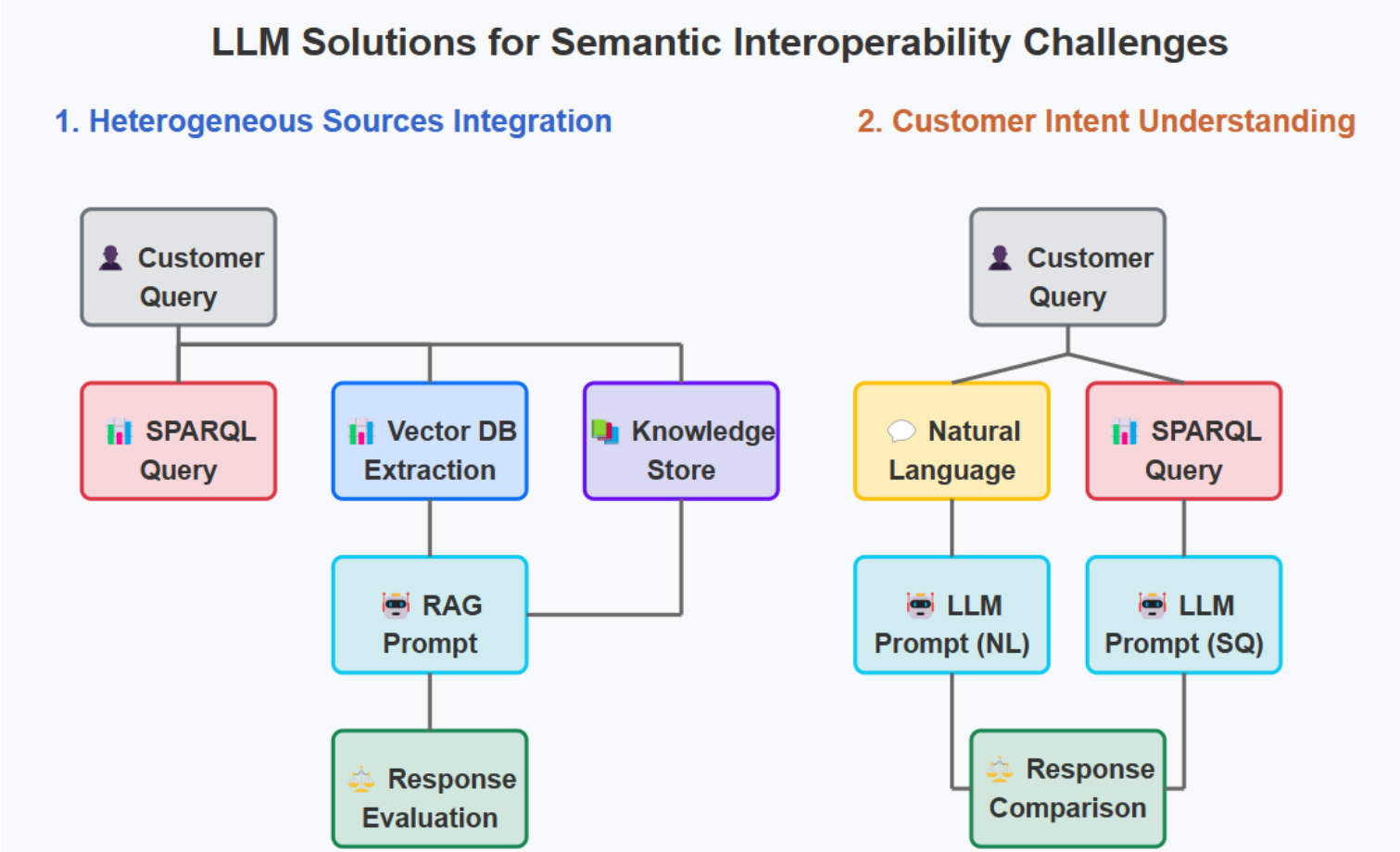
- Trade-off of Vector and Knowledge Graphs for RAG
- RAG with SPARQL prompting method

Hypothesis & Expectations

- Vector search methods for semantic similarity of query with textual corpus provides implicit semantic interoperability
- Existing semantic interoperability of structured stores can be combined implicitly with unstructured knowledge stores
- Self-Attention, Positional Encoding and Conditional Probabilities have bigger impacts from structured queries
- Correlations between query type and ideal knowledge source



Thank You



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