Distributed Query Processing over a Wide-Area Network

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POSITIONING

CONTEXT
- Growing volume of scientific data
- Distribution of data in many acquisition sites
- Data publication for cross-analysis or secondary reuse

CHALLENGES
Distributed Query semantics
- To define and enforce a clear SPARQL DQP semantics

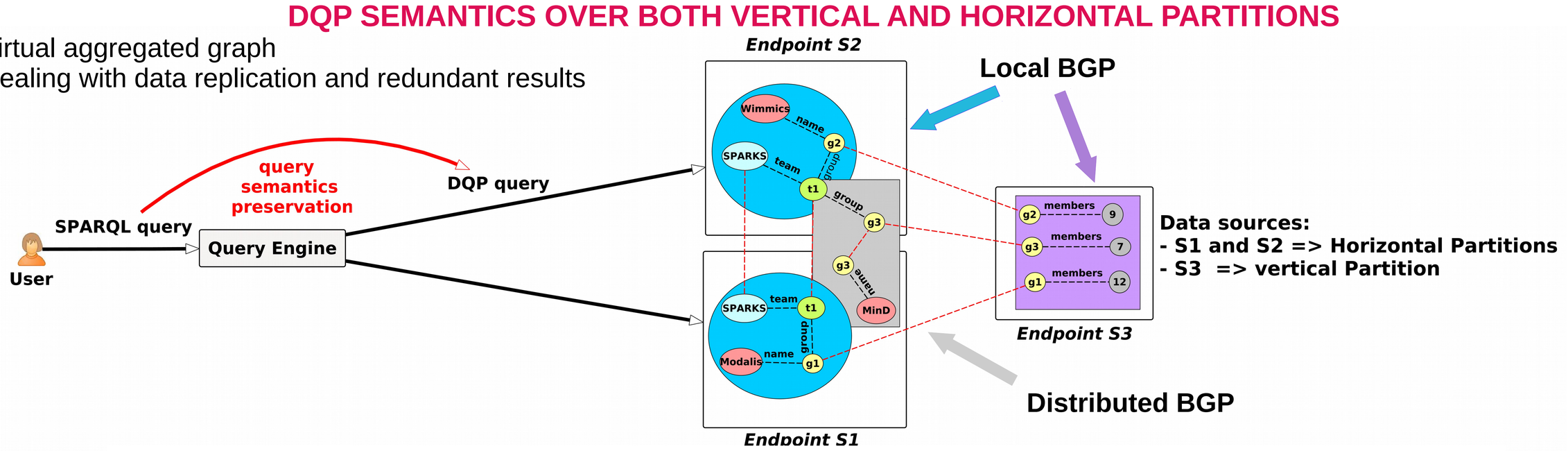
Performance and reliability
- To transform queries and generate execution plans that can be executed efficiently in parallel

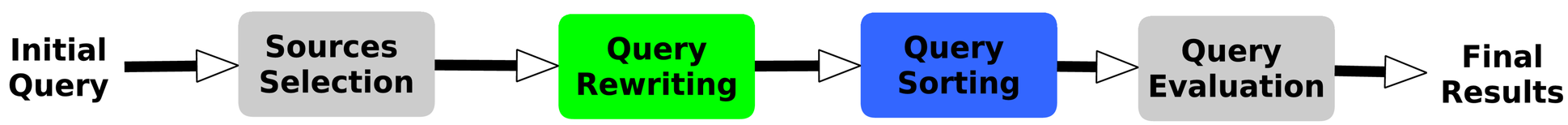
OBJECTIVES
- To optimize performance and reliability of Distributed querying
- To design a SPARQL-compliant parallel query engine (KGRAM-DQP)
- To demonstrate the relevance of DQP techniques in realistic use cases

APPROACH: Distributed Query Processing (DQP)

DQP SEMANTICS OVER BOTH VERTICAL AND HORIZONTAL PARTITIONS

- Virtual aggregated graph
- Dealing with data replication and redundant results





SPARQL QUERY REWRITING

```
SELECT ?team ?group ?name ?members
WHERE {
 ?team ns:team  "SPARKS".
 ?team ns:group ?group.
 ?group ns:name ?name.
 ?group ns:members ?members.
 }
```

BGP_1 from S_1 U S_2

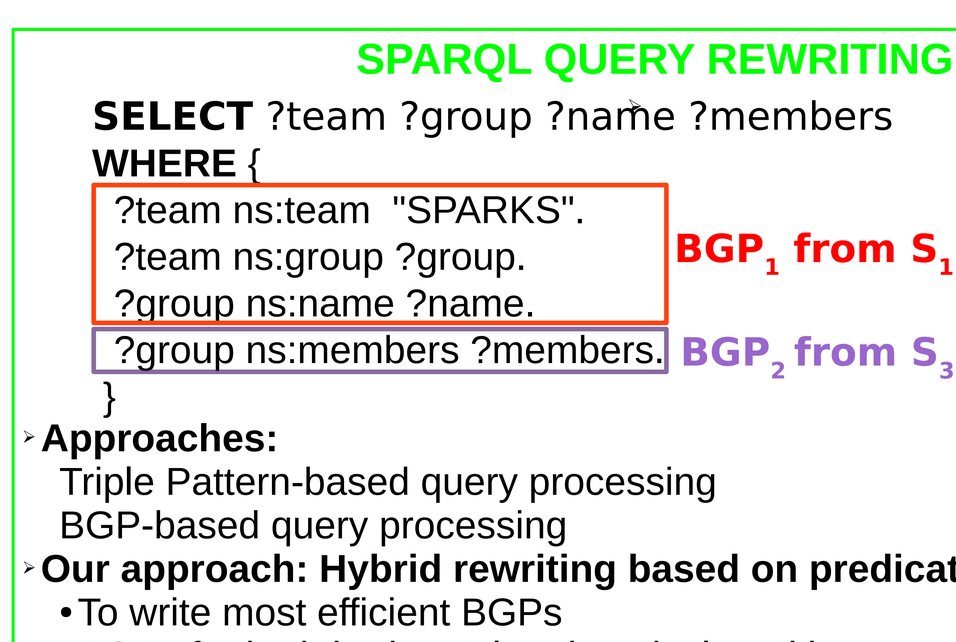
BGP_2 from S_3

- **Approaches:**
  - Triple Pattern-based query processing
  - BGP-based query processing
- **Our approach: Hybrid rewriting based on predicates distribution**
  - To write most efficient BGPs
  - BGPs for both horizontal and vertical partitions
    - BGP-based for all local BGPs
    - Triple Pattern-based for distributed BGP

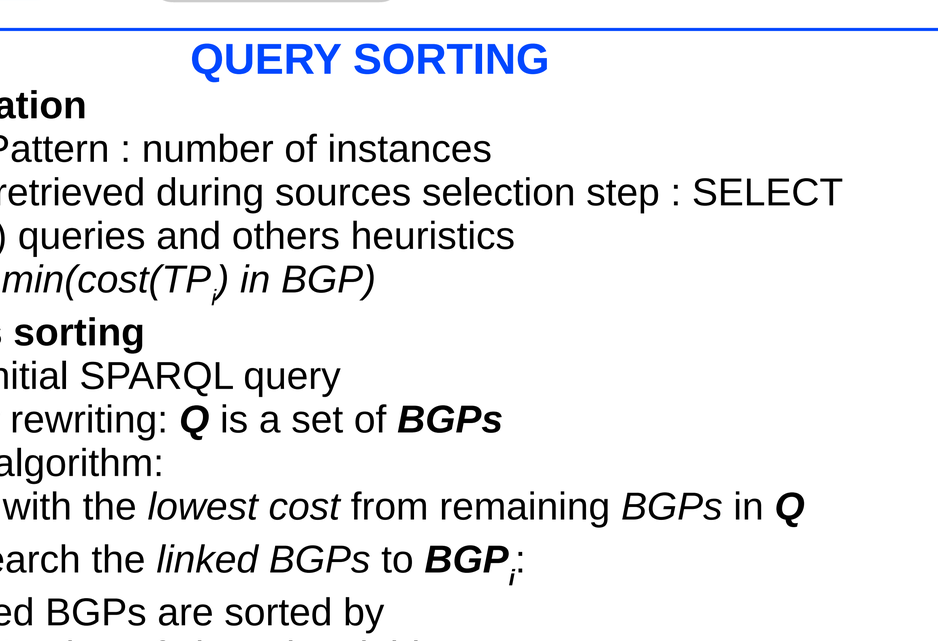
QUERY SORTING

- **Cost Estimation**
  - For Triple Pattern : number of instances
    Statistics retrieved during sources selection step : SELECT COUNT(*) queries and others heuristics
  - For BGPs: *min(cost(TP_i) in BGP)*
- **Subqueries sorting**
  - Let ***Q*** the initial SPARQL query
  - After query rewriting: ***Q*** is a set of ***BGPs***
  - Recursive algorithm:
    - Get BGP_i with the *lowest cost* from remaining *BGPs* in ***Q***
      - Then search the *linked BGPs* to BGP_i:
        Linked BGPs are sorted by
        - *Number of shared variables*
        - *Number of linked BGPs*
  - *Filters and Values added to linked BGPs*

RESULTS



- **Demographic and geographic data (INSEE)**
  - P1 (duplication)
  - P2 (global rewriting)
  - P3 (partial rewriting)
- **FedBench Benchmark**
  - Data sources :
    - DBpedia
    - NYTimes
    - KEGG
    - DrugBank
    - ChEBI
  - Life science queries



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