Distributed Query Planner in Calder System

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Problem and solution

- Motivating application is Calder which is shown in above figure
- Stream resources highly distributed and asynchronous
- Scientific application needs streams in real-time
- Cost metrics in general incapable of distinguishing different plans in this domain.
- Hundreds of existing queries become reusable resources for system. New techniques to utilize these resources are needed.

Solution

- Extending cost metric space
- Efficient query distribution and assignment algorithm
- Inventing novel query re-using techniques for new application.

Extended cost metric space

Rate-based cost model

- Computation cost is computed based on the input stream’s input rate instead of the cardinality
- Minimum computation cost is the goal to choose the query plan

Extended cost metrics

- Query deployment cost
- Query compiling, optimization and set-up time
- Query re-using cost
- Re-usable query searching and tuning time
- Query execution cost
- Network transmission cost

Cost estimation

- Use statistic data to estimate the unit processing cost for different objects

Structure-sharable query

Motivation

- Hundreds of sensors generate streams in the same format
- Streams are highly asynchronous
- Query Structure: query tree just with operation nodes

Optimal Compatible Sub-Plan Set

- Based on tree-matching algorithm
- Find optimal coverage with the existing query set

Re-usable query tuning

- Reserved attribute: queryID
- Add “Marker” and “deMark” node
- Tune projection and join node

Summary

Conclusion and Contribution

- Data-driven scientific application brings new challenges to traditional query cost model
- Novel metric space considers deployment cost and network bandwidth cost
- Multi-query optimization techniques are evaluated in new application domain
- Novel structure-sharable query and its searching, tuning algorithm

Future Work

- Work on more effective greedy-based query distribution algorithm
- Experimentally analyze how reuse threshold varies under different working scenarios.