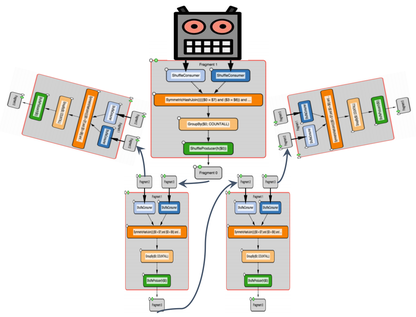


HybridPerfopticon

Query Visualization for Hybrid Distributed Database Systems

Brandon Haynes & Shrainik Jain

Introduction

Problem Statement

Can existing query visualization techniques be extended across multiple database systems?

- No system currently exists that visualizes and profiles queries across multiple database systems (a “hybrid” database system)
- We extended the Perfopticon (Moritz, Halperin, Howe & Heer, 2015) framework to multiplex plans drawn from arbitrary remote database systems
- Our system highlights the relevant components of each system-specific query plan and identifies data flowing into and out of each system

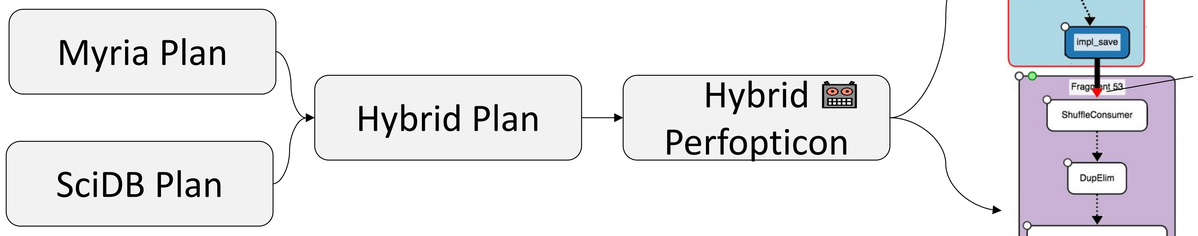
Motivation

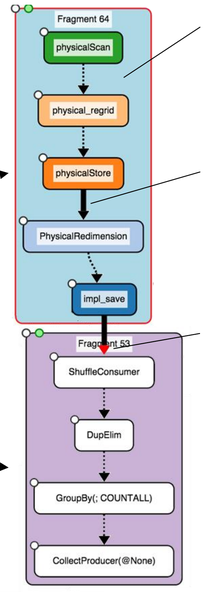
What techniques are required to transform disparate plans into a common format?

- Perfopticon’s intended extension method requires extensive operator instrumentation and other timing metrics. Since these data are largely already present in the logging infrastructure, can we use it as a ready source of profiling metrics?
- Coordination of multiple database plans requires changes to the Perfopticon system, and converting profiling metrics to a common format is error-prone

Approach

We extended Perfopticon to display plans from the Myria and SciDB database management systems. Plans from each system are combined into a “hybrid plan” and each component is assigned an origin system. The individual plans within each hybrid plan may contain additional metadata relevant to that system. These plans are fed into HybridPerfopticon for visualization.





Plan fragments are color-coded by database system

SciDB Myria

Cardinalities of database transfers are contextually width-encoded

No data transfer → Dominating transfer

Units of data transfer are counted in contextually-atomic units (e.g., array elements for SciDB, tuples for Myria) and arrow width is weighted by total within-fragment output (or plan, for inter-fragment shuffle/transfers).

Inter-database transfer skew is binned and color-encoded

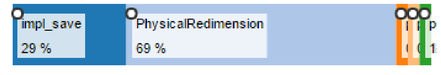
No transfer skew → Extreme transfer skew

Skew is displayed as a (normalized) mean over the previous two seconds (in order to avoid distracting rapid fluctuations).

Worker contribution and operator metrics are encoded by DBMS

PhysicalRedimension
335 tuples returned, took 511 ms

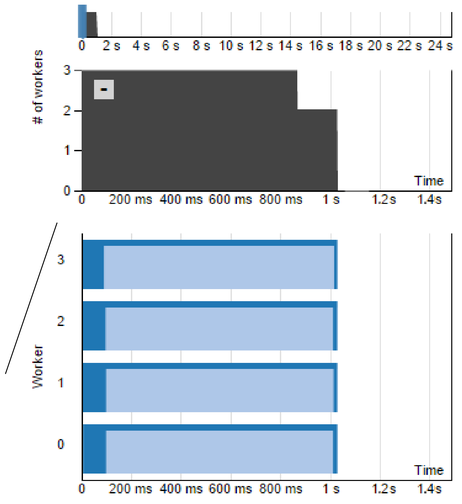
Running time: 3 s 874 ms
SciDB ⇨ Myria: 27,236
Myria ⇨ SciDB: 0
shuffled tuples: 112,336



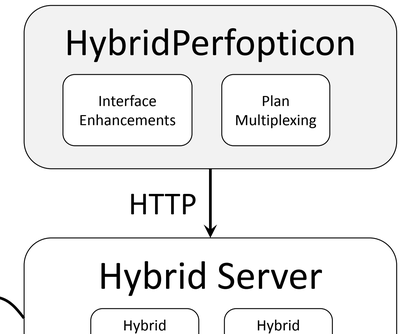
Operators from each DBMS are displayed in the detail view

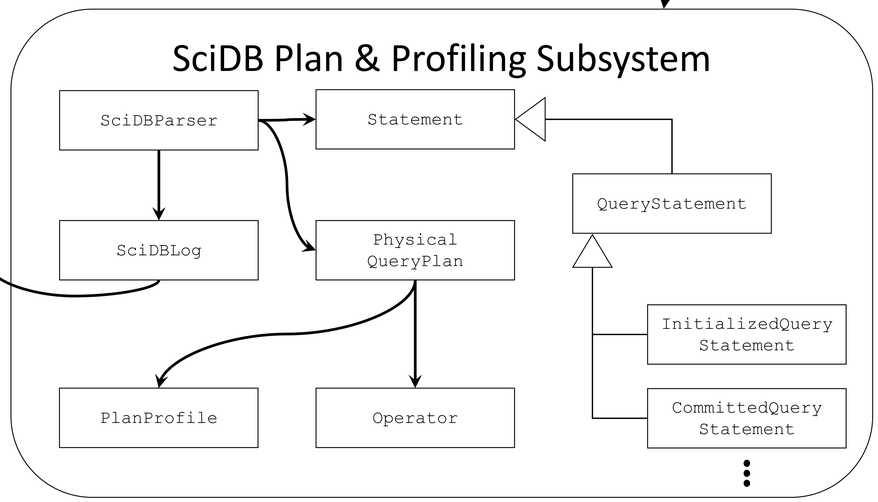
SciDB impl_save, PhysicalRedimension, physicalStore, physical_regrid, physicalScan, …

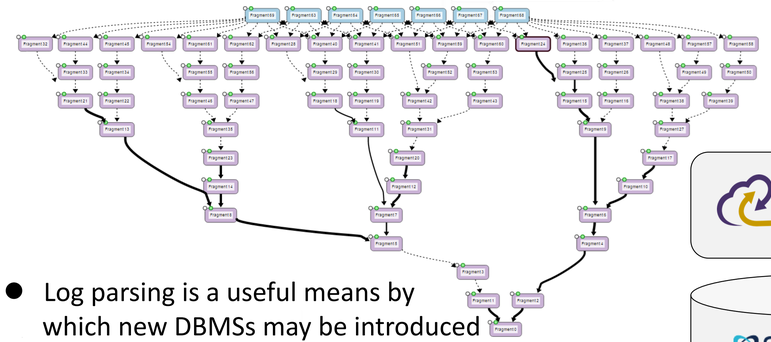
Detailed execution



HybridPerfopticon Architecture







Myria

SciDB Logs

Results

Hybrid Query Visualization

We profiled a hybrid version of a complex, real-world query and demonstrated that it is accurately visualized

Conclusions

Log parsing works well as an easy extension point for new DBMSs

- Log parsing is a useful means by which new DBMSs may be introduced
- HybridPerfopticon is a useful tool with which to visualize and debug hybrid database queries

Future Work

Additional performance and caching logic is needed

- Additional performance work is needed (e.g., caching parsed logs)
- The mapping between atomic elements (e.g. tuples, graph vertices, array elements) in database systems needs additional refinement