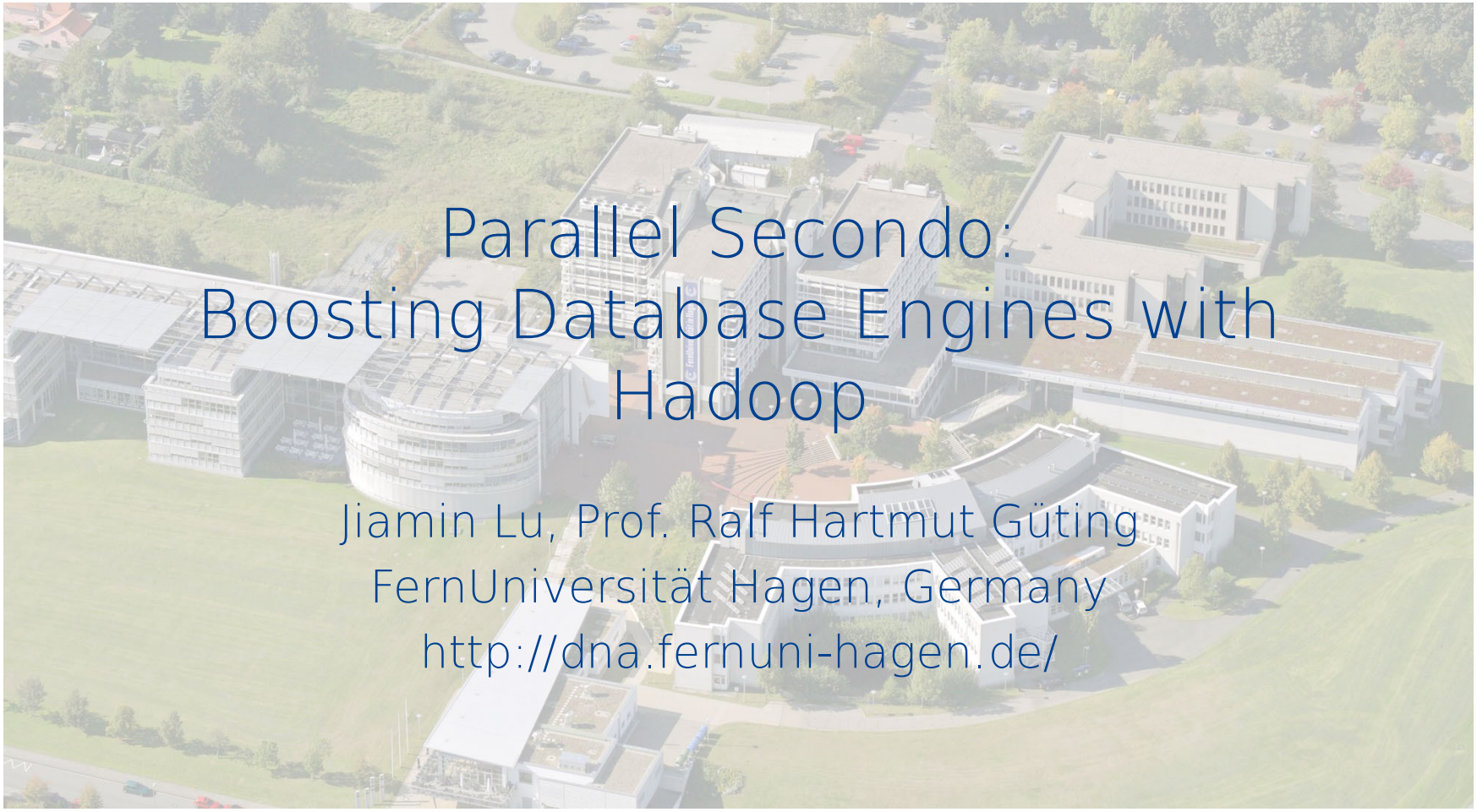


Parallel Secondo: Boosting Database Engines with Hadoop

Jiamin Lu, Prof. Ralf Hartmut Güting
FernUniversität Hagen, Germany
http://dna.fernuni-hagen.de/

Scale Of Cloud

- Dropbox 40 PB
- Facebook over 100 PB
- SkyDriver 300 PB
- Amazon S3 90 ~ 900 PB

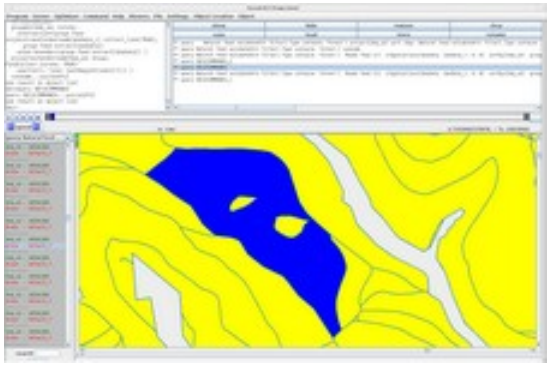
Google Spanner

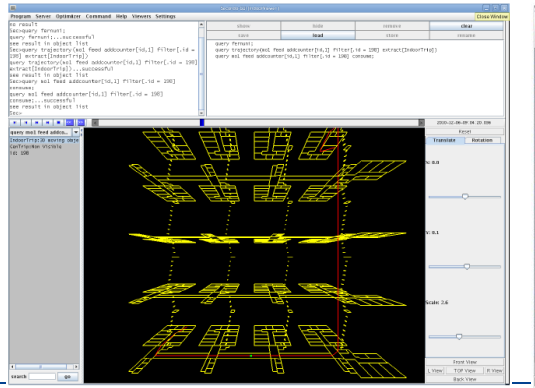
System S

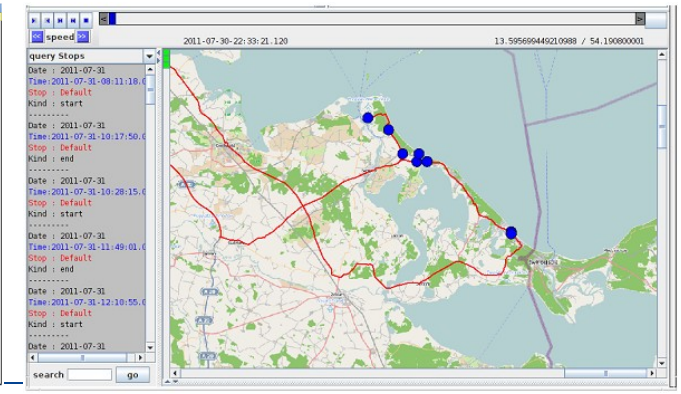
Microsoft Research Dryad

SECONDO

- Developed for a decade
- Include 71 algebras
  - Tens of data types
  - Thousands of operators
- Extended with various database technologies
  - Data models: Relational, Object-Oriented, Nested-Relation
  - Data types: Spatial objects, Moving objects, Music, Pictures, ...
- A vivid graphic user interface







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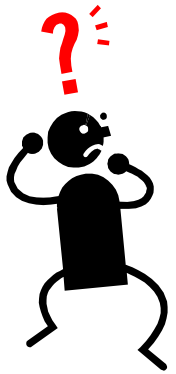
Parallel Processing



Vision of Parallel Secondo

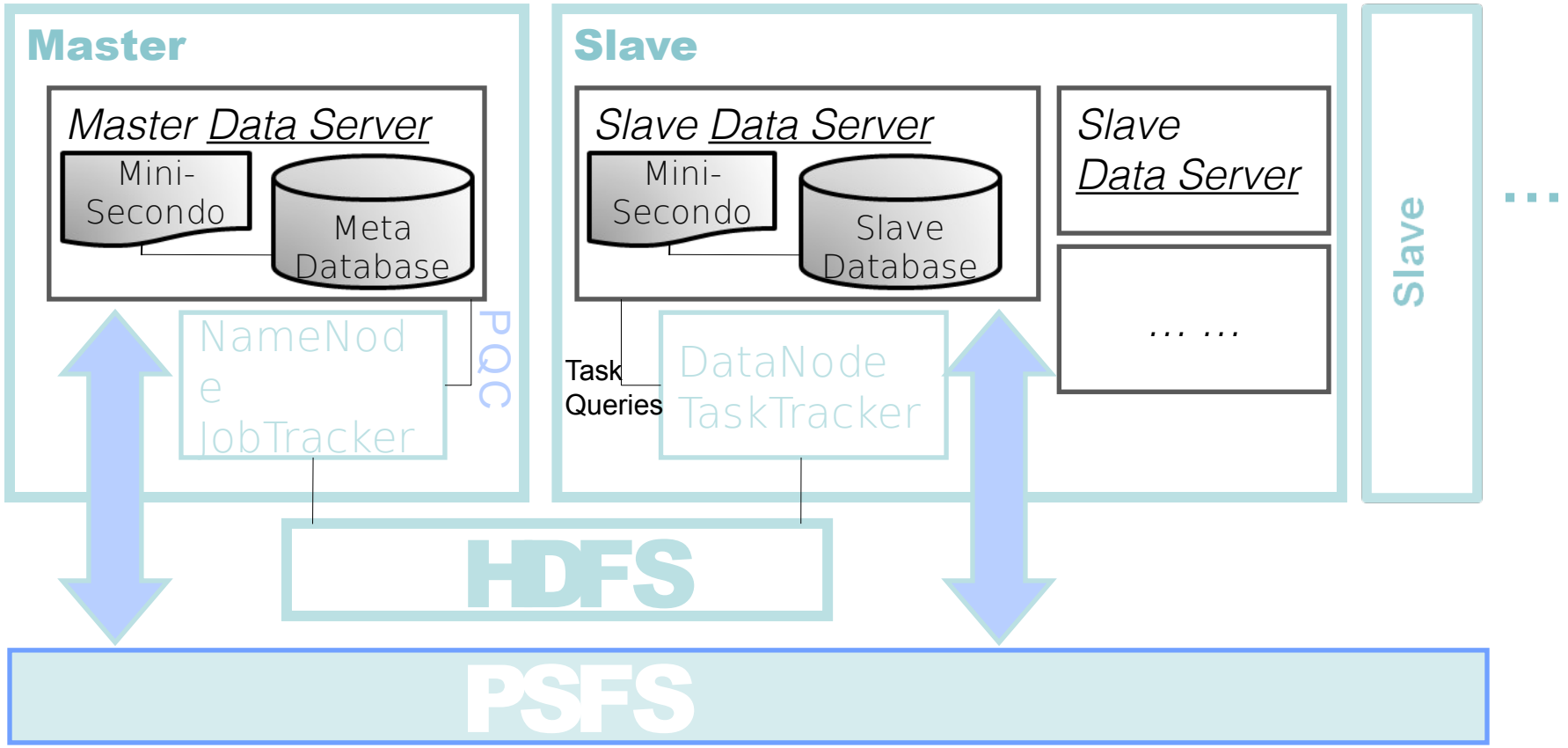
- Efficient performance
- Comprehensive and extensible interface
- Easy-to-use environment
- Large scale capability

+

SECONDO

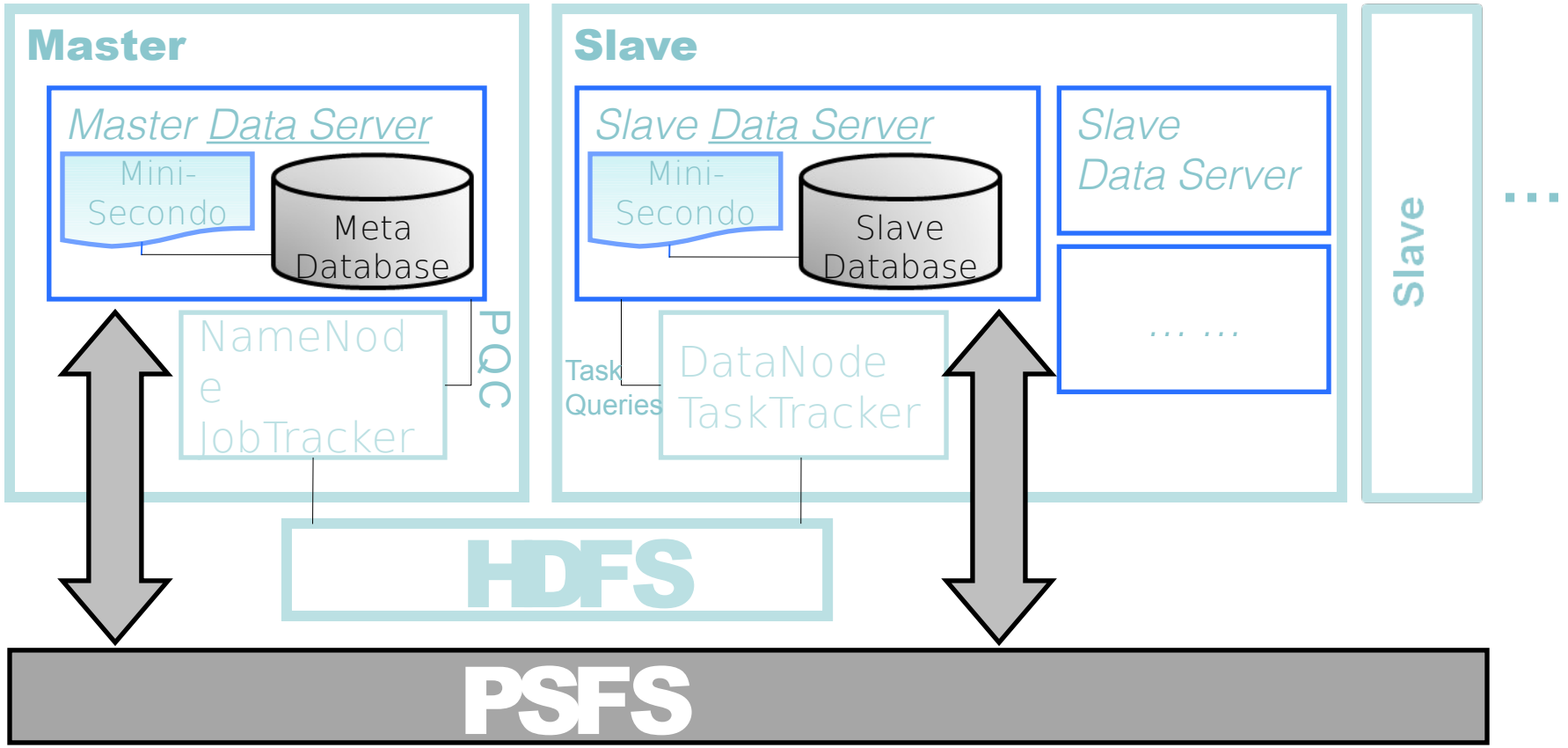
Infrastructure

Independence



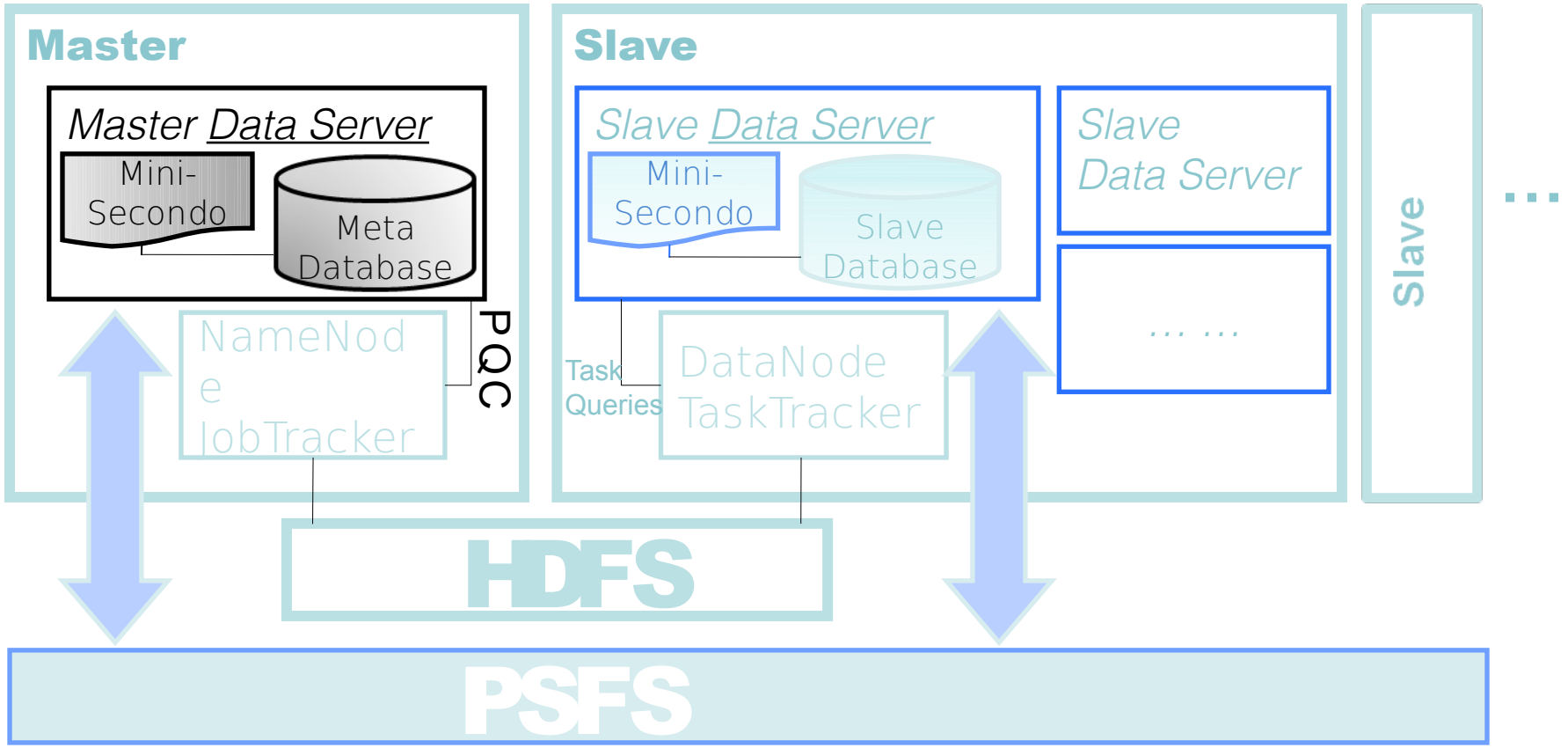
Infrastructure

Efficiency



Infrastructure

Compatibility



Parallel Data Model

Parallel Objects – DELIVERABLE

	Small-Sized	Large-Sized
Equal	DELIVERABLE	Duplication
Unequal	PS-Matrix	PS-Matrix

D = 100;

Parallel Query

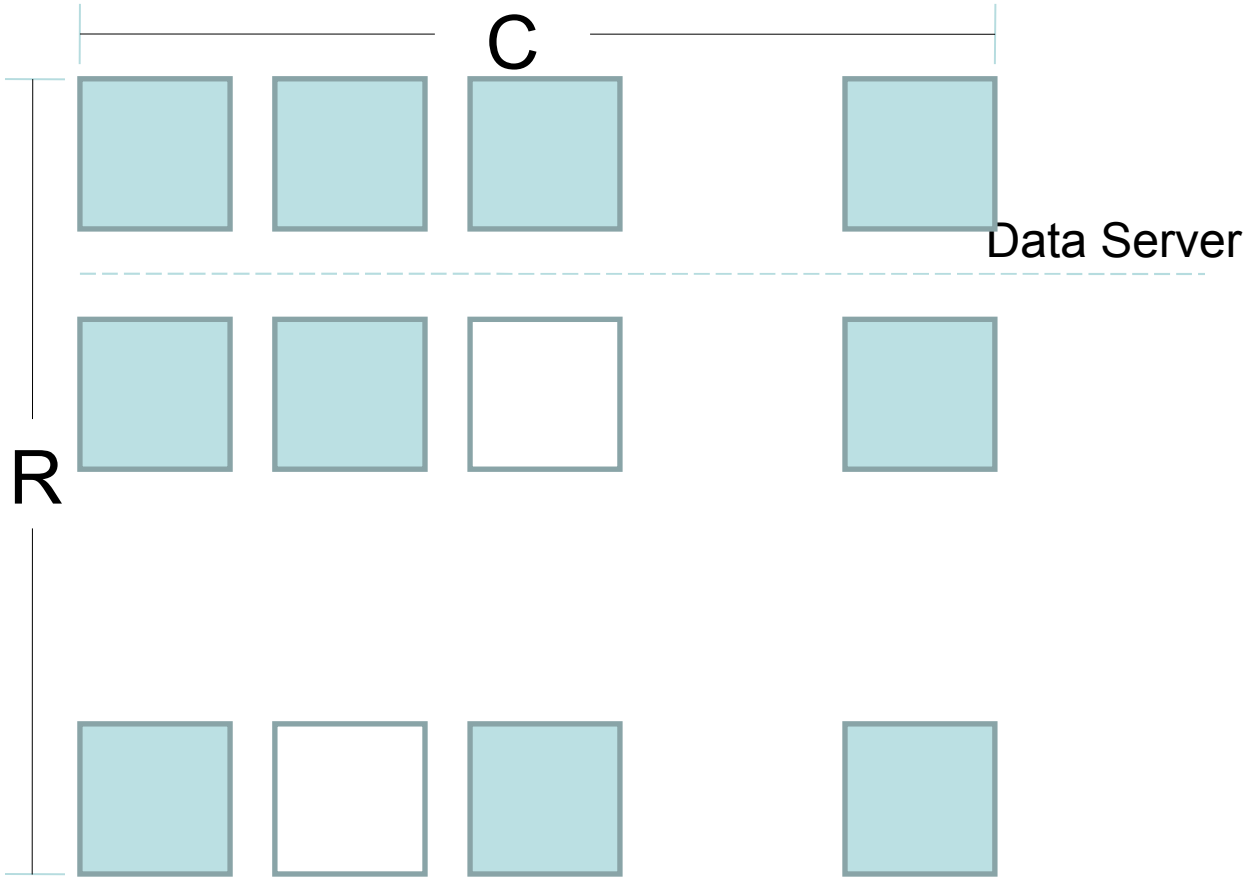
… filter[… = D] …

Task Query

… filter[… = 100] …

Parallel Data Model

Parallel Objects – PS-Matrix (flist)



DLO

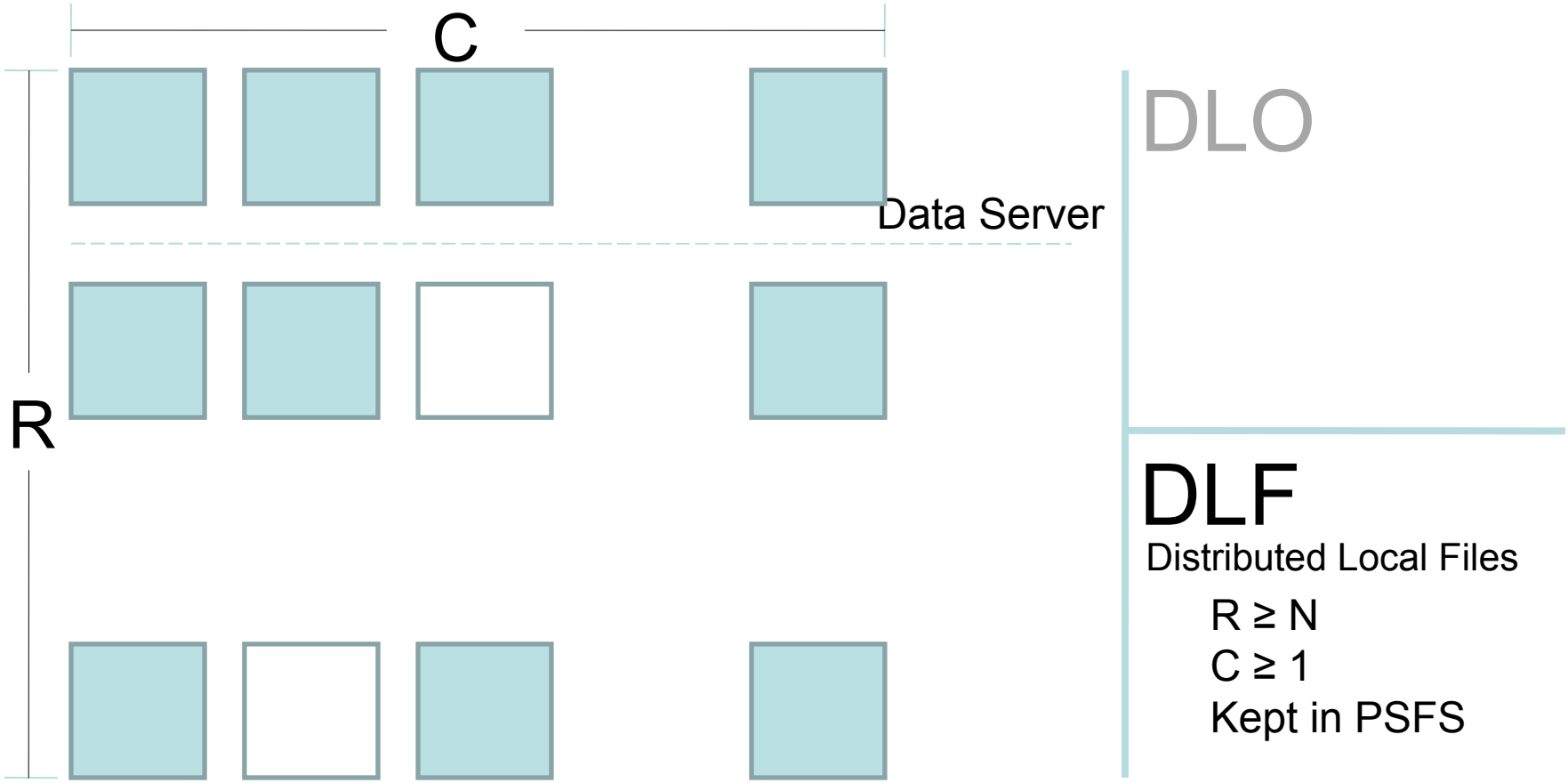
Distributed Local Objects

R = N
C = 1
Kept in database

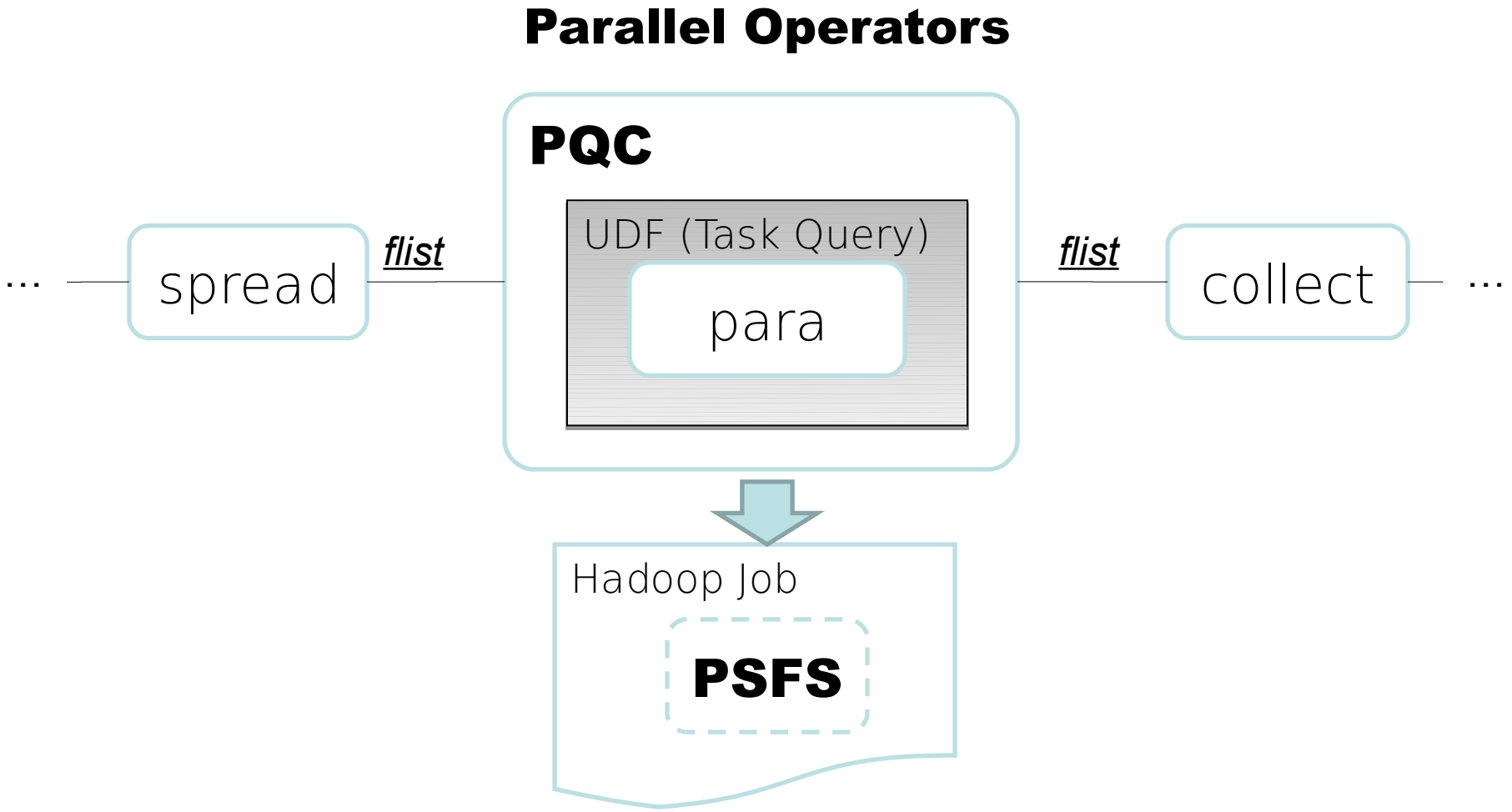
DLF

Parallel Data Model

Parallel Objects – PS-Matrix (flist)



Parallel Data Model

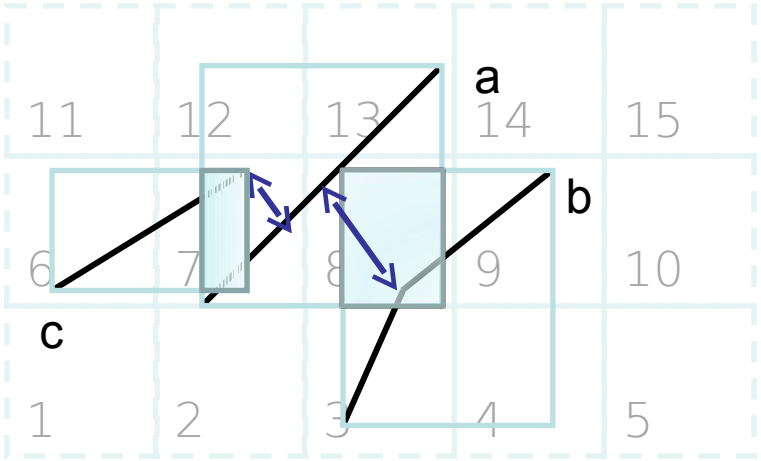


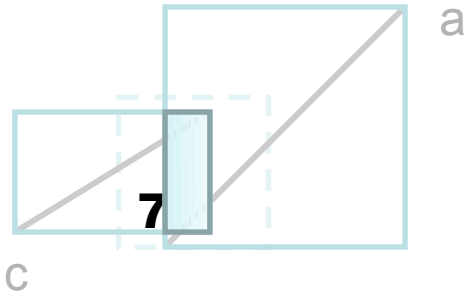
Example Query

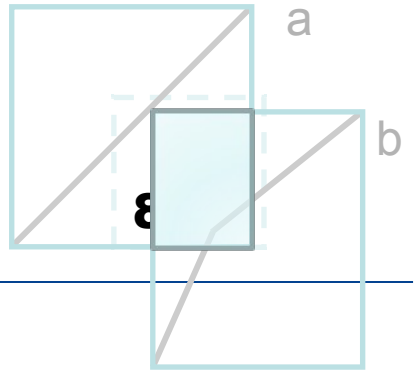
The 6th query of BerlinMOD benchmark:

Find all *truck*-pairs which have been as close as 10 meters or less to each other, sometimes within the observation period.

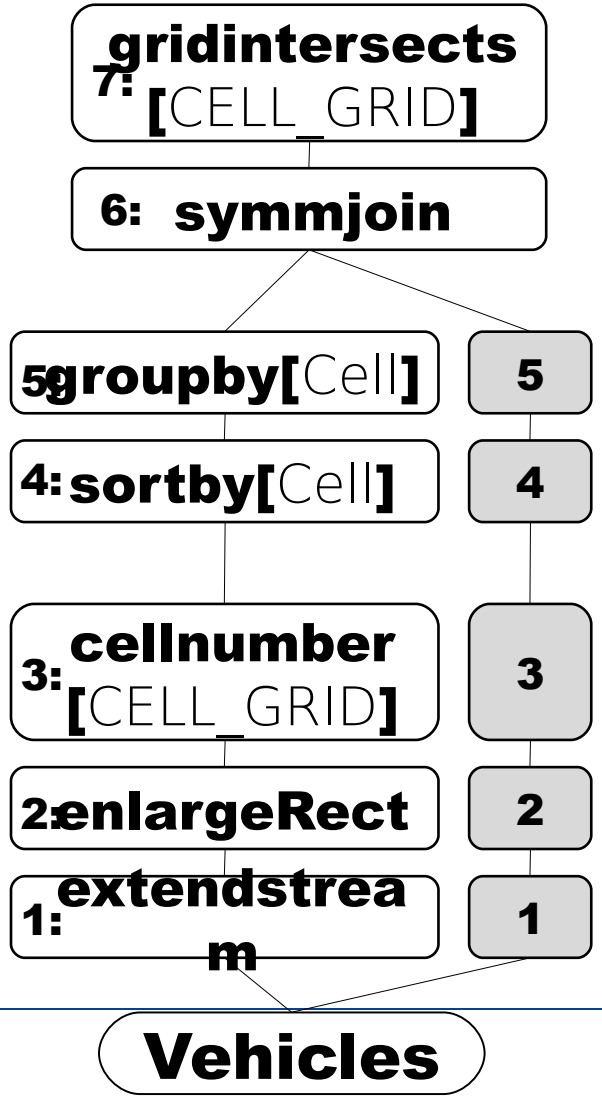
PBSM: Partitioned-Based Spatial Merge [12]

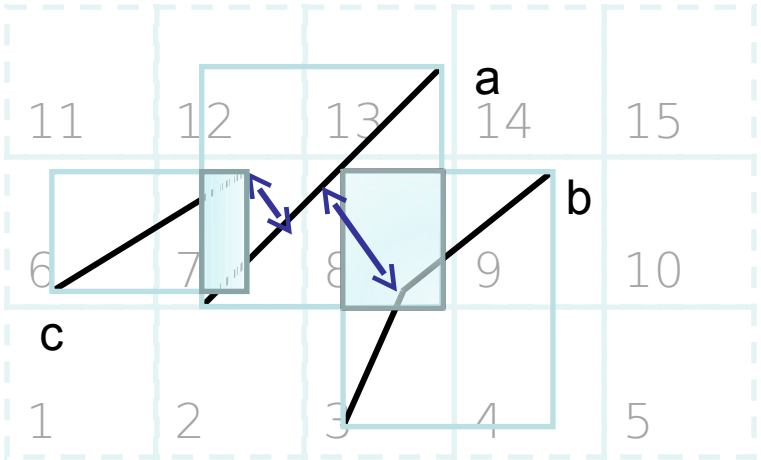




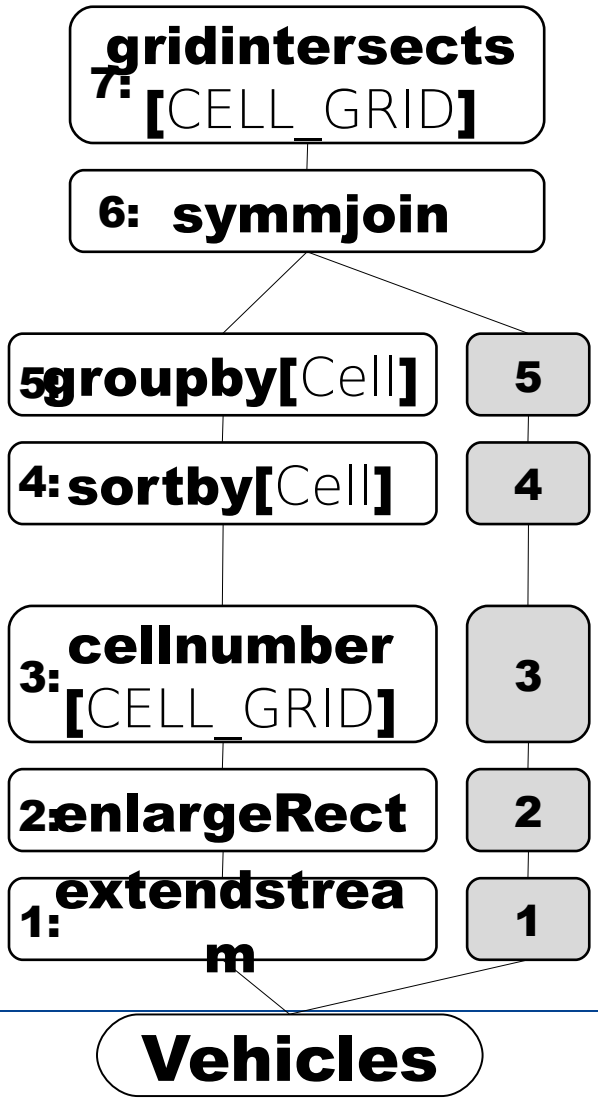


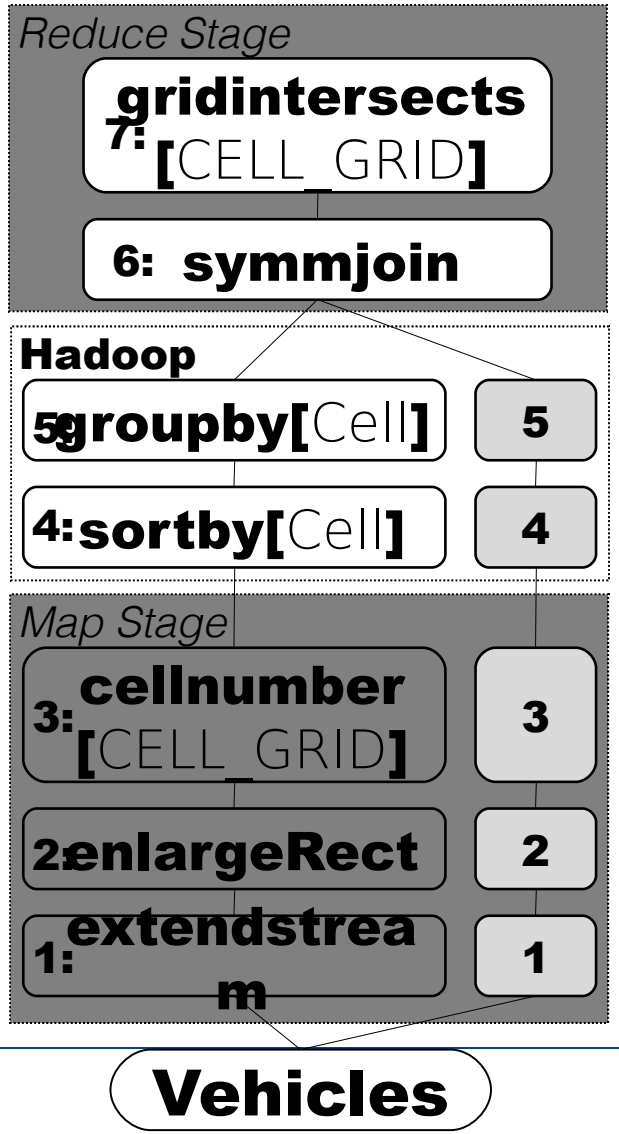
Example Query



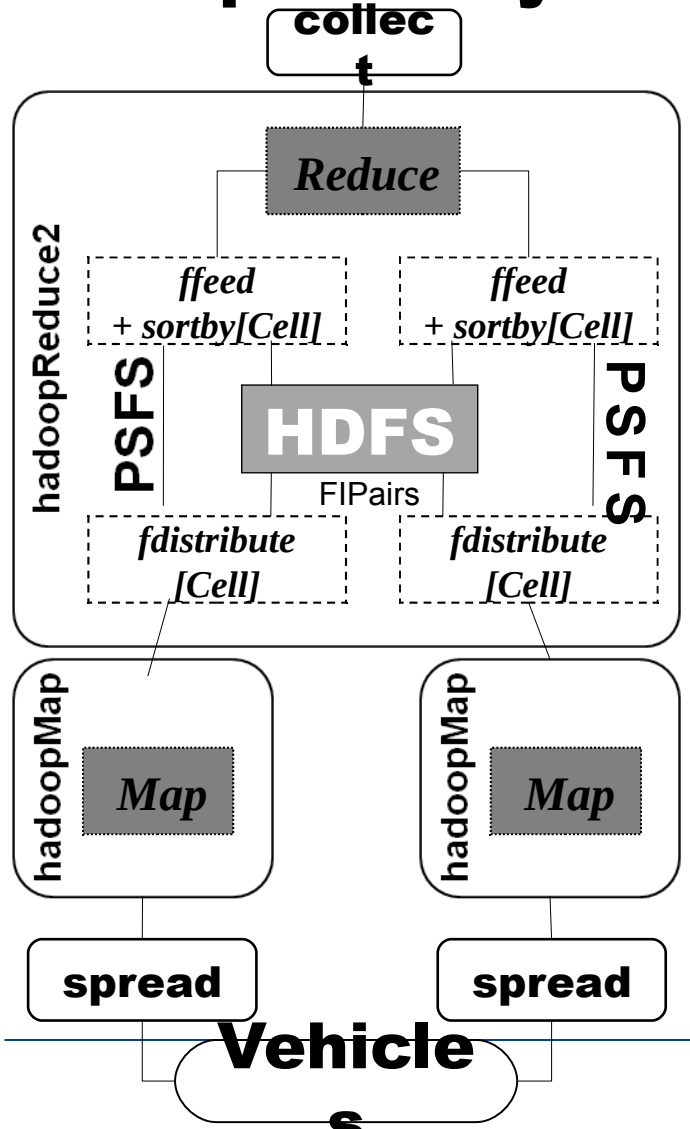


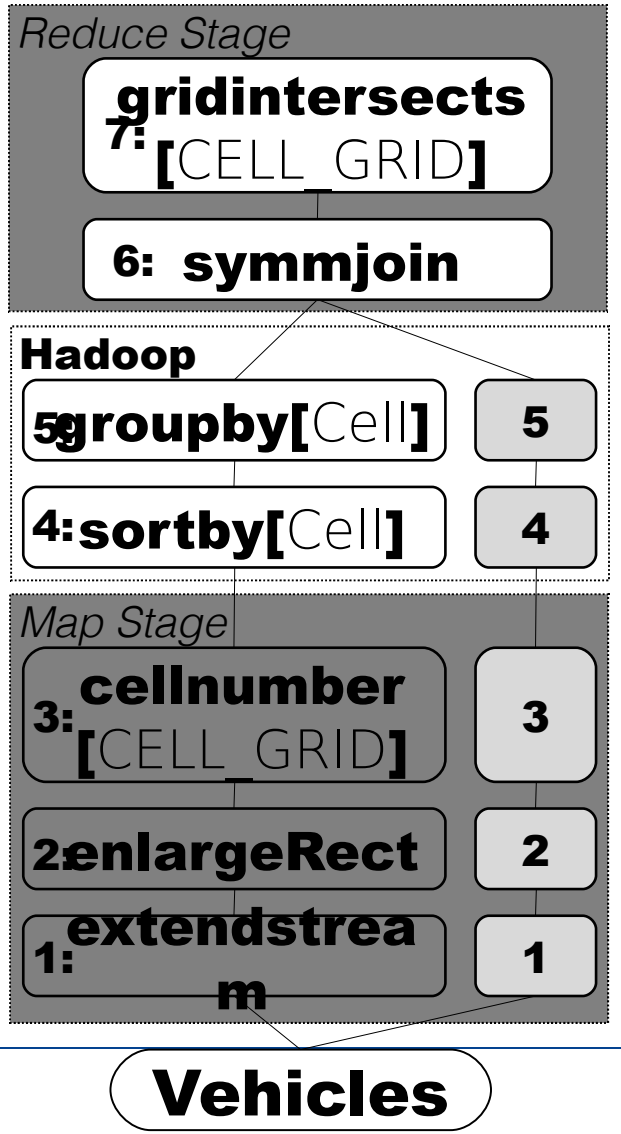
Example Query





Example Query





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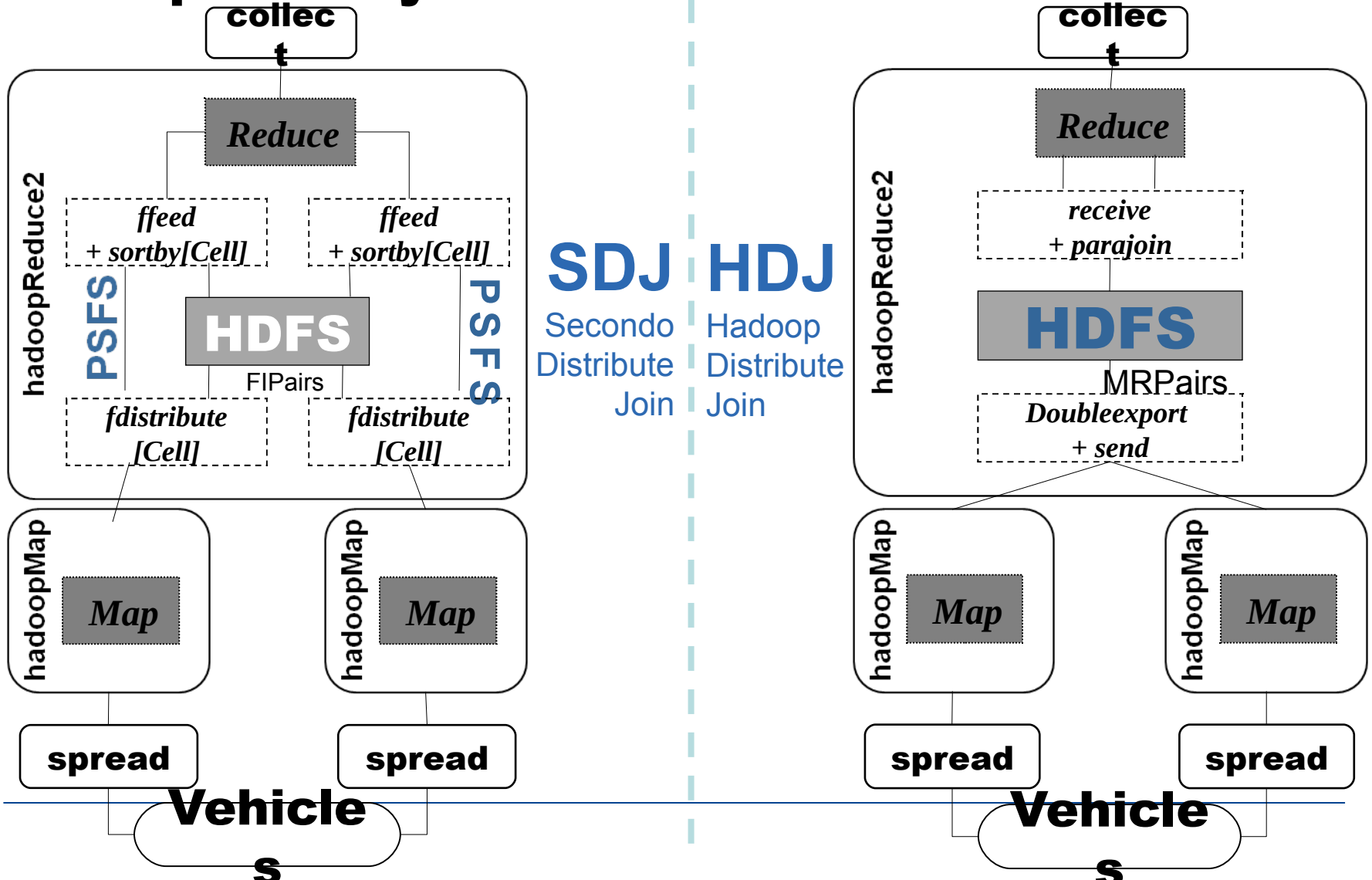
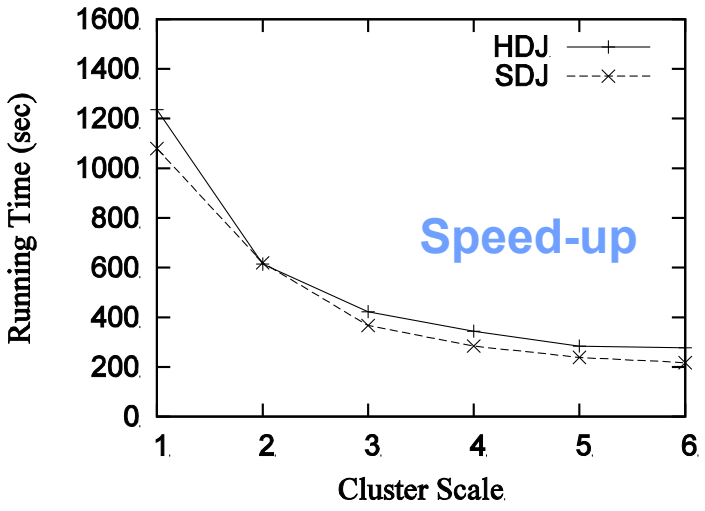
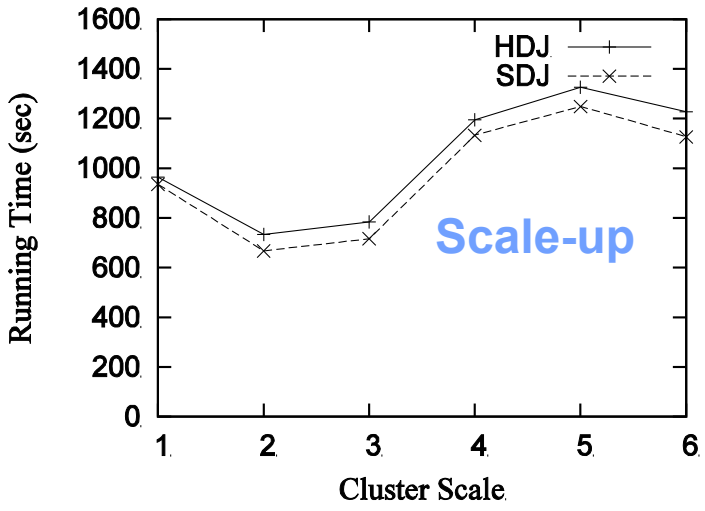


Example Query

- Cluster
  - **6** computers, **12** data servers.
  - Each has a AMD processor with 6 cores, 8 GB memory, 2 x 250GB disks.
- Data Set
  - **BerlinMOD** benchmark
  - 2000 vehicles in 28 days, 11GB. (Scale Factor = 1)





Cloud Evaluation (Amazon EC2)

- Data Generation
  - Cluster with 110 large instances.
  - BerlinMOD data set with scale factor of 30.
    - 10,954 vehicles in 153 days, with 350 GB.
    - 5 hours.
- Example Query
  - Evaluated in clusters consisting of 50 to 150 computers

Achievement of Parallel Secondo

- Efficient performance
  - Linear speed-up and scale up
  - More efficient than conventional Hadoop extensions
- Comprehensive and extensible interface
  - Completely keeps the extensibility of Secondo
  - Parallel queries are expressed in sequential query language
- Easy-to-use environment
  - A set of auxiliary tools
  - Public Amazon image will be offered soon
- Large and flexible scale capability
  - Single computer
  - Clusters consisting of tens or hundreds of computers


Q&A