Introduction to Database Systems CSE 444

Lecture 23: Pig Latin (continued)

Where we are…

- Previously…
  - LOAD – read data
  - FOREACH – with and without flatten
  - FILTER
  - JOIN
  - GROUP BY
- Now…
  - COGROUP: A generic way to group tuples from two datasets together

Co-Group

Dataset 1 results: {(queryString, url, position)}
Dataset 2 revenue: {(queryString, adSlot, amount)}

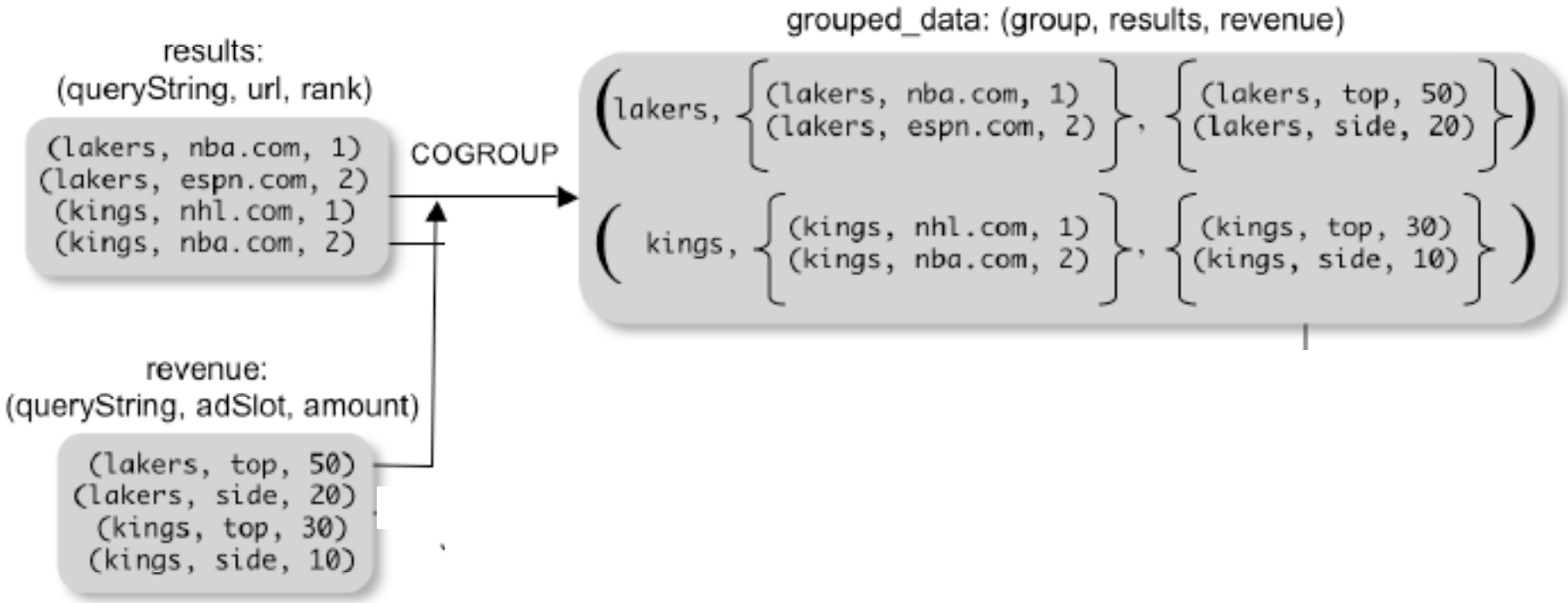
```
grouped_data =
      COGROUP results BY queryString,
                  revenue BY queryString;
```

grouped_data: {(queryString, results:{(url, position)},
revenue:{(adSlot, amount)})}

What is the output type in general ?

{group_id, bag dataset 1, bag dataset 2}

Co-Group



Is this an inner join or an outer join ?

Co-Group

grouped_data: {(queryString, results:{(url, position)},
revenue:{(adSlot, amount)})}

```
url_revenues = FOREACH grouped_data
      GENERATE
            FLATTEN(distributeRevenue(results, revenue));
```

…where distributeRevenue is a UDF that accepts search results and revenue information for a query string at a time, and outputs a bag of urls and the revenue attributed to them.

Co-Group v.s. Join

grouped_data: {(queryString, results:{(url, position)},
revenue:{(adSlot, amount)})}

```
grouped_data = COGROUP results BY queryString,
                       revenue BY queryString;
join_result = FOREACH grouped_data
              GENERATE FLATTEN(results),
                       FLATTEN(revenue);
```

Result is the same as JOIN

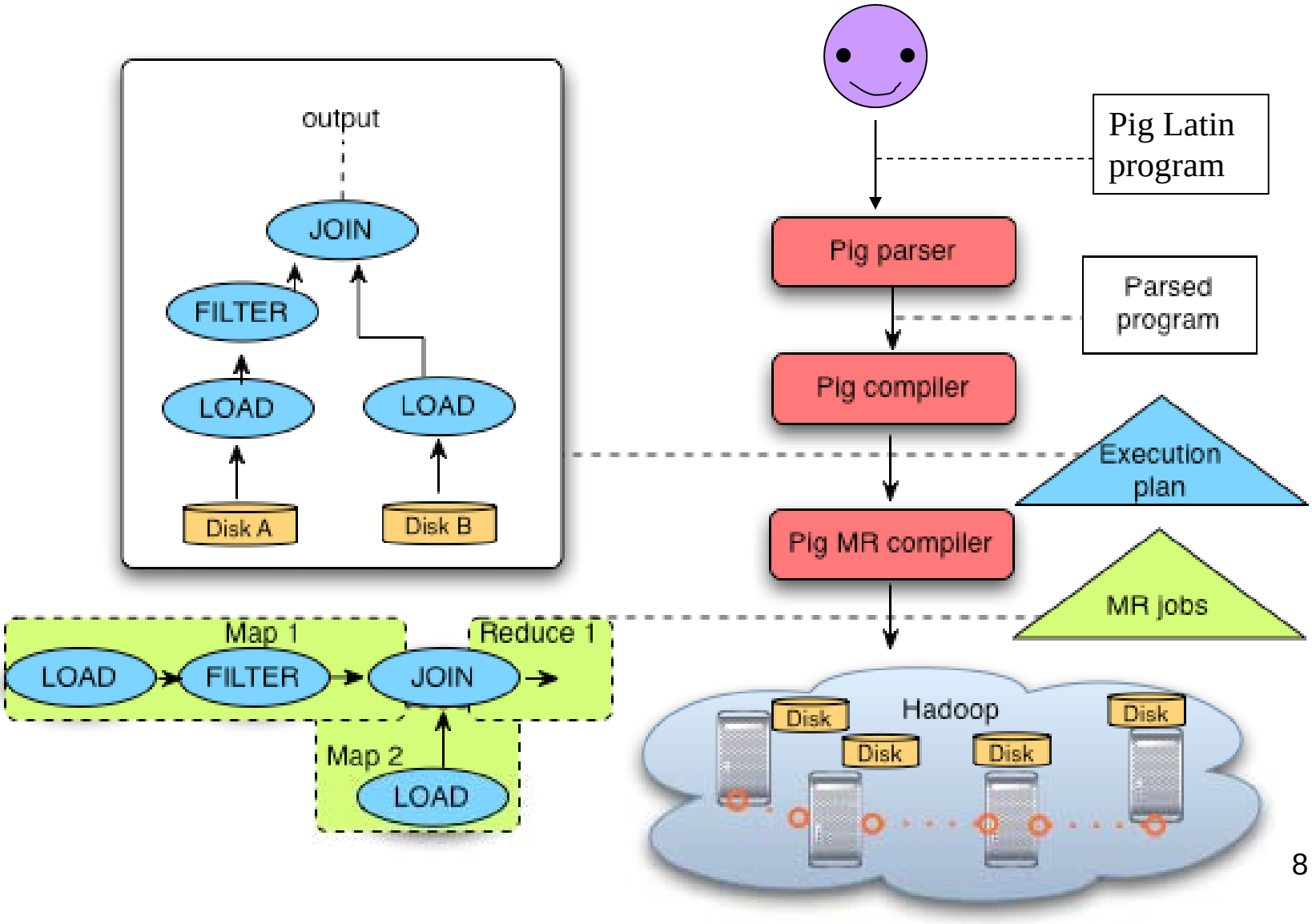
Asking for Output: STORE

```
STORE query_revenues INTO `theoutput'
USING myStore();
```

Meaning: write query_revenues to the file ‘theoutput’

This is when the entire query is finally executed!

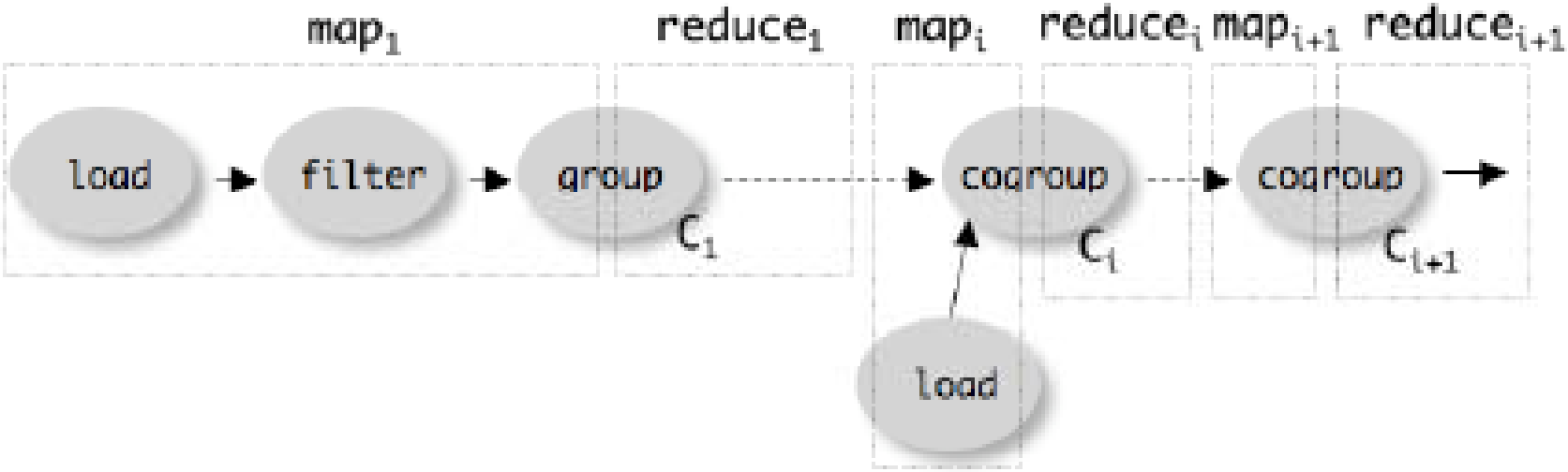
Query Processing Steps



Implementation

- Over Hadoop
- Parse query:
  - All between LOAD and STORE → one logical plan
- Logical plan → ensemble of MapReduce jobs
  - Each (CO)Group becomes a MapReduce job
  - Other ops merged into Map or Reduce operators
- Extra MapReduce jobs for sampling before SORT operations

Implementation



Advice for the Project

- Always run first locally
  - Test your program on your local machine, on a smaller dataset
  - After you debugged the program, send it to the cluster
- Batch processing:
  - Keep in mind that Hadoop does batch processing
  - Your job takes 2-7 minutes on the cluster*
  - No-one else can run on the same compute nodes during this time !!*

*Guidelines from previous versions of the project on a research cluster. Not sure how it will apply on AWS.

Longer Example: Tutorial Script 2

- Goal: Process a search query log file and find search phrases that occur with particular high frequency during certain times of the day

```
raw = LOAD 'excite-small.log'
        USING PigStorage('\t') AS (user, time, query);

clean1 = FILTER raw BY
            org.apache.pig.tutorial.NonURLDetector(query);
```

Longer Example: Tutorial Script 2

```
clean2 = FOREACH clean1
         GENERATE user, time,
         org.apache.pig.tutorial.ToLower(query)
         as query;

houred = FOREACH clean2
         GENERATE user,
         org.apache.pig.tutorial.ExtractHour(time)
         AS hour, query;
```

Longer Example: Tutorial Script 2

```
ngramed1 = FOREACH houred
                GENERATE user, hour,
   flatten(org.apache.pig.tutorial.NGramGenerator(query))
   AS ngram;

ngramed2 = DISTINCT ngramed1;

hour_frequency1 = GROUP ngramed2 BY (ngram, hour);
hour_frequency2 = FOREACH hour_frequency1
  GENERATE flatten($0), COUNT($1) as count;
```

Longer Example: Tutorial Script 2

```
hour_frequency3 = FOREACH hour_frequency2
   GENERATE $0 as ngram, $1 as hour, $2 as count;

hour00 = FILTER hour_frequency2 BY hour eq '00';
hour12 = FILTER hour_frequency3 BY hour eq '12';

same = JOIN hour00 BY $0, hour12 BY $0;
```

Longer Example: Tutorial Script 2

```
same1 = FOREACH same
    GENERATE hour_frequency2::hour00::group::ngram
    AS ngram, $2 as count00, $5 as count12;

STORE same1
     INTO 'script2-local-results.txt' USING PigStorage();
```