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Design Patterns, Combiners and Dictionaries

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What is a design pattern?

Resources for MapReduce Design Patterns are plentiful

Donald Miner and Adam Shook's book 'MapReduce Design Patterns' lists six types of patterns specifically for MapReduce

1. Summarization patterns

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Pattern format in Miner & Shook

- Intent
- Motivation
- Applicability
- Structure
- Consequences
- Resemblances
- Known uses
- Performance Analysis

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Summarization patterns

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Numerical summarizations

- Intent
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Intent

Group records together by a key field and calculate a numerical aggregate per group

Consider f to be a generic numerical summarization function, given a list of values $(v_1, v_2, \ldots, v_n)$, we'd be trying to find a value α i.e. $\alpha = f(v_1, v_2, \ldots, v_n)$

Numerical summarizations

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Motivation

Data sets are large these days! Too hard to discern meaning without a top-level view of the data.

Numerical summarizations

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Applicability

Should be used when both of the following are true:

- You are dealing with numerical data
- The data can be grouped by specific fields

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Numerical summarizations

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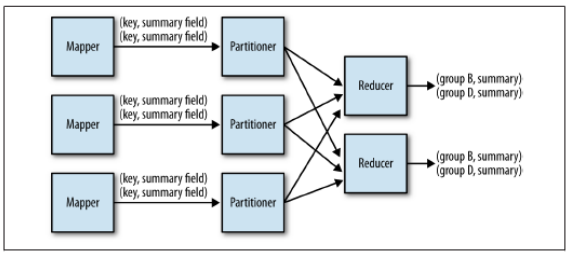
Structure



MapReduce Design Patterns – Donald Miner & Adam Shook (2013)

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Numerical summarizations

- Intent
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Consequences

The output of the job will be a set of files containing a single record per reducer input group. Each record will consist of the key and all aggregate values.

Numerical summarizations

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Resemblances

Analogous patterns in both SQL and Pig

Numerical summarizations

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Known uses

Word count, Min/Max/Count, Average/Median/Standard Deviation

Numerical summarizations

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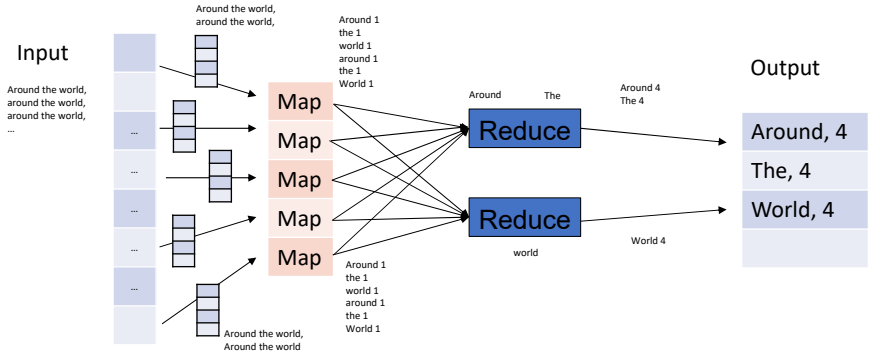
Performance analysis

MapReduce was built for these types of jobs, it performs well. However there are still factors to be cautious of. The authors note that mastery of the combiner can significantly effect performance in some scenarios.

On the topic of combiners…



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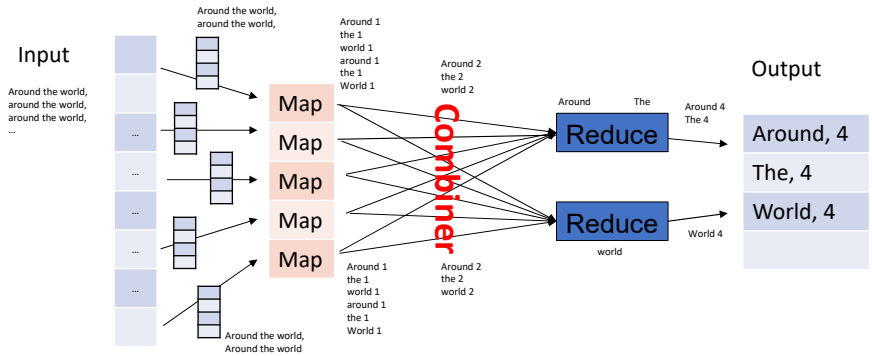
On the topic of combiners…



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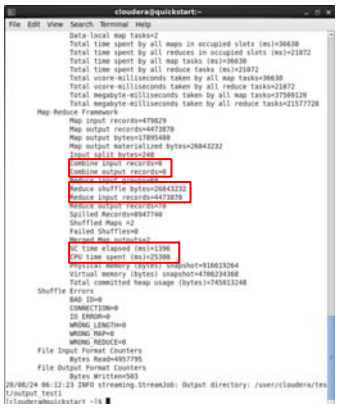
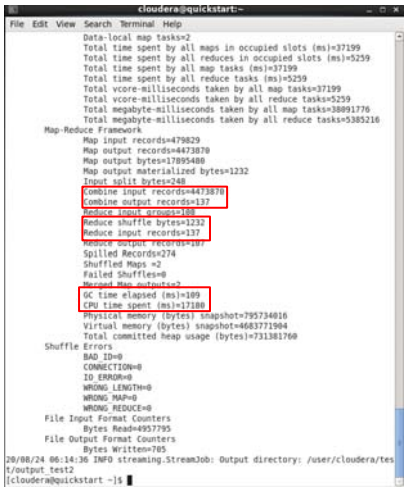
No combiner



With combiner

```
[cloudera@quickstart ~]$ hadoop jar /usr/lib/hadoop-0.20-mapreduce/contrib/streaming/hadoop-streaming-mr1.jar -mapper /home/cloudera/test1/src/mapper.py -combiner /home/cloudera/test1/src/reducer.py -reducer /home/cloudera/test1/src/reducer.py -input /user/cloudera/test1/input/* -output /user/cloudera/test/output_test2
```



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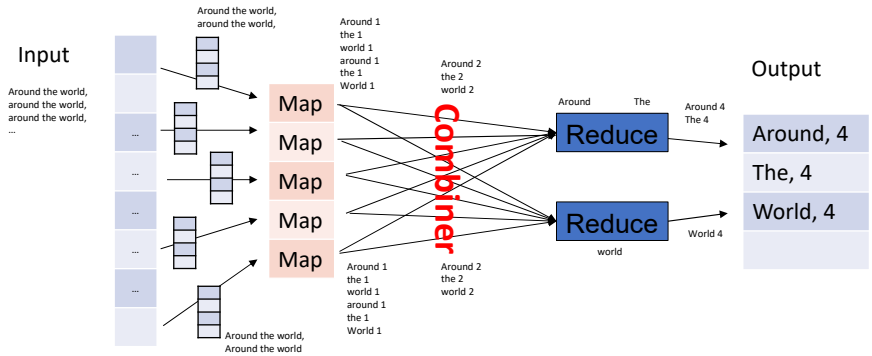

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Dictionaries

In Python a dictionary is a collection which is unordered, changeable and indexed. Dictionaries are written with curly brackets, and they are also structured with key/value pairs

Define dictionary

```
myDictionary = {
"Name": "Mr Robot",
"Year": "2015",
"Seasons": "4"}
```

Access items

```
x = myDictionary["Year"]
or
x = myDictionary.get("Year")
```

Change items

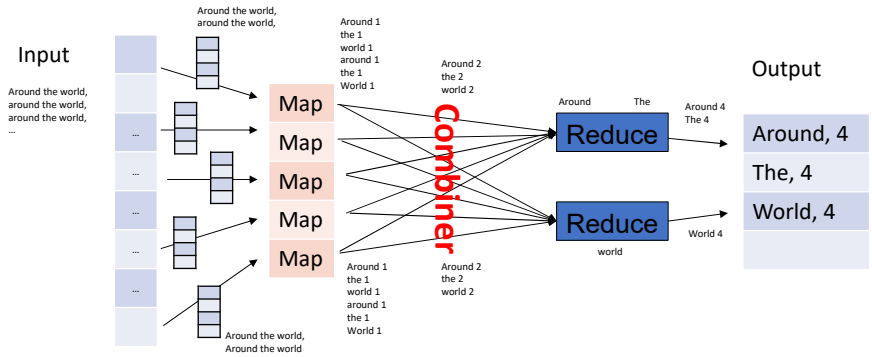
```
myDictionary["Year"] = 2019
```

Loop through keys and values

```
for x in myDictionary:
        print(x)
        print(myDictionary[x])
```

```
for x in myDictionary.values:
        print(x)
```


Combiners using dictionaries



lyrics = {} → "Around" IF → exists → lyrics["Around"] = lyrics["Around"]+1

IF → !exists → lyrics["Around"] = 1

→ Next word…