Discussion Session
Week 8

INF 141: Information Retrieval
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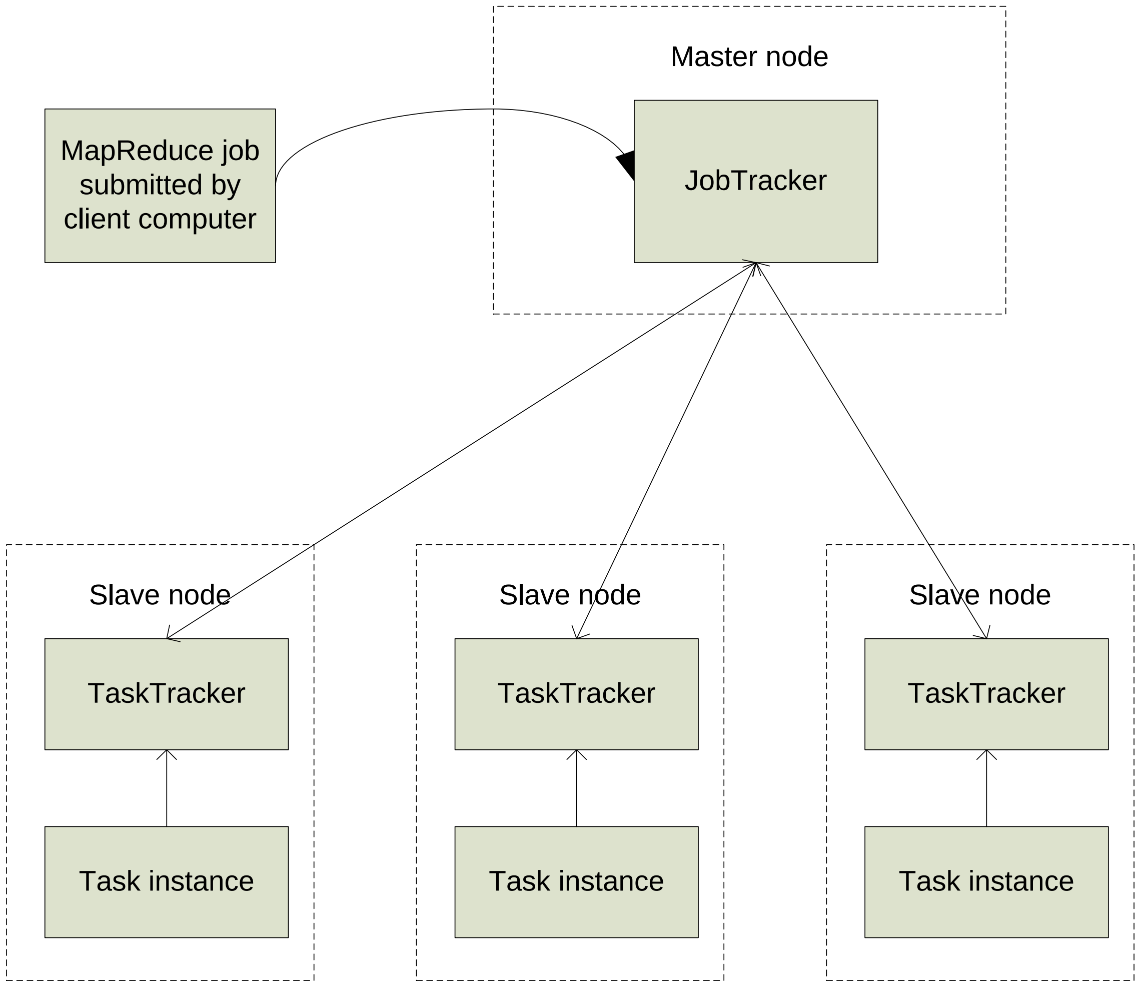
Some Terminology

- Running “Word Count” across 20 files is one ***job***
- 20 files to be mapped imply 20 ***map tasks*** + some number of ***reduce tasks***
- At least 20 map ***task attempts*** will be performed… more if a machine crashes.

Task Attempts

- A particular task will be attempted at least once, possibly more times if it crashes
- If the same input causes crashes over and over, that input will eventually be abandoned.

MapReduce: High Level



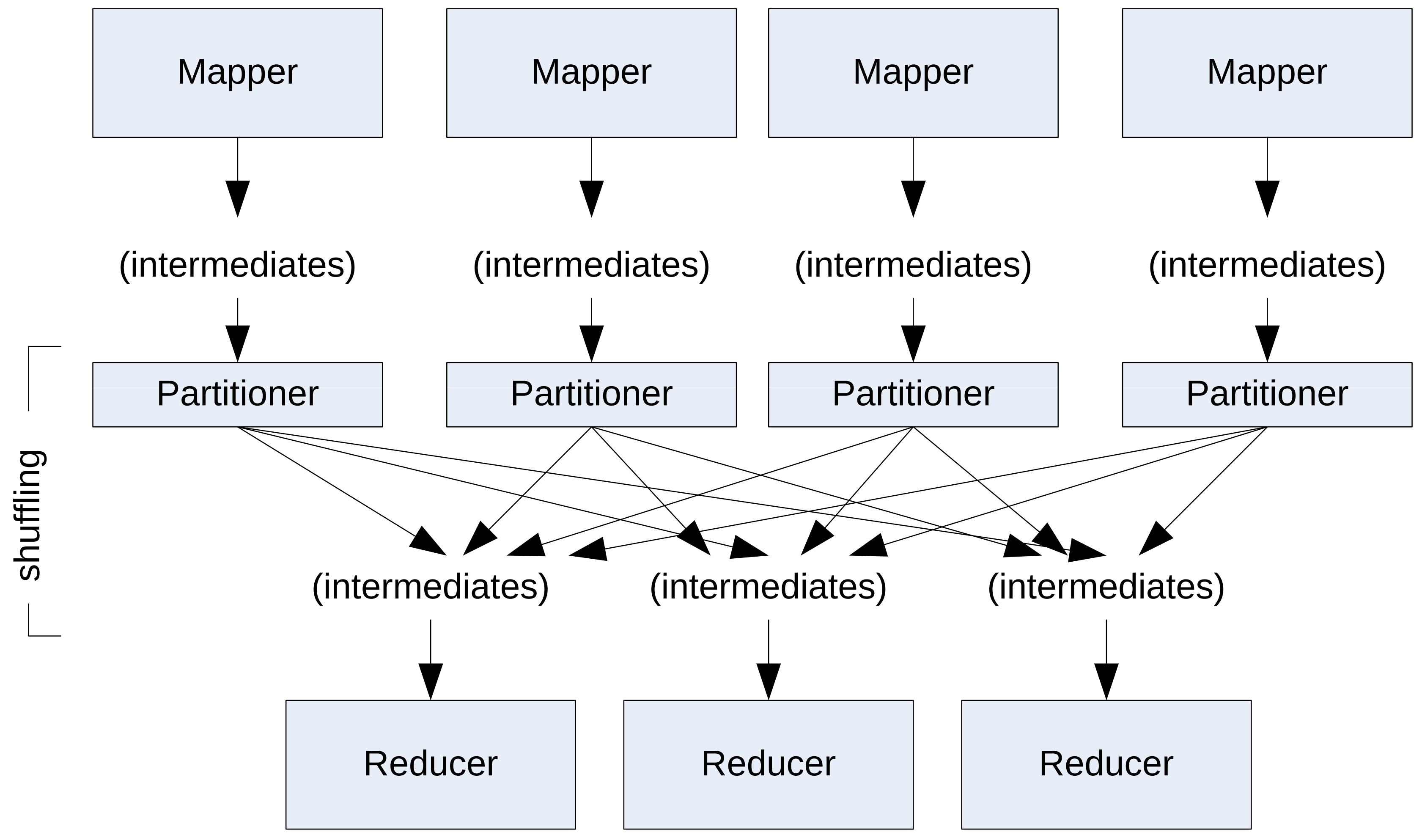
Nodes, Trackers, Tasks

- Master node runs *JobTracker* instance, which accepts *Job* requests from clients

- *TaskTracker* instances run on slave nodes

- TaskTracker forks separate Java process for task instances

Partition And Shuffle



Partitioners

- Partitioners are application code that define how keys are assigned to reduces.
- Default partitioning spreads keys evenly, but randomly
  - Uses key.hashCode() % num_reduces

Default Partitioning in PostingLists

part-00000

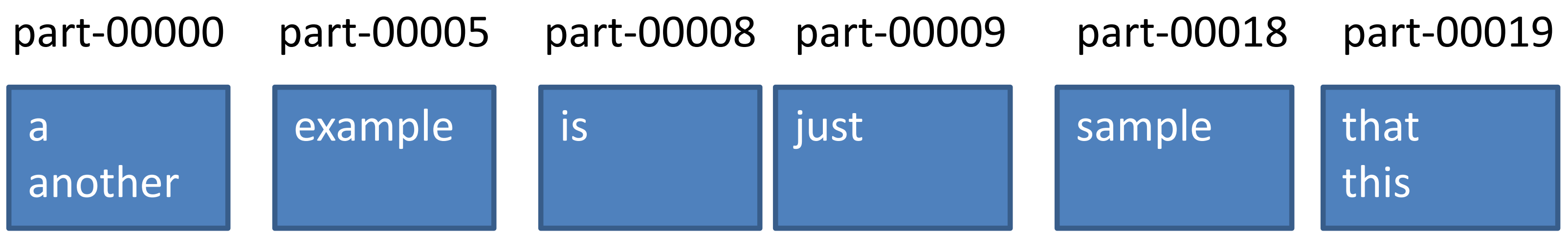
```
a
is
sample
this
```

part-00001

```
another
example
just
that
```

```
sort –m part-* > merged-result.txt
```

A Better Approach: Custom Partitioning



```
cat part-* > merged-result.txt
```

Partitioners

```
/*Support alphabetical reduce buckets */
public static class MyPartitioner implements Partitioner<Text,Text>{

     public void configure(JobConf arg0) {
     }

     public int getPartition(Text key, Text value, int numPartitions) {
         String s = key.toString();
         if(s.length() > 1){
              return(s.charAt(0) % numPartitions);
         }
         else{
             return(0);
         }
     }
}
```

Is this Good?

```
/*Write the outputs into alphabetical part-00000 files */
conf.setPartitionerClass(MyPartitioner.class);
conf.setNumReduceTasks(26);
```

Hadoop Job Scheduling

- FIFO queue matches incoming jobs to available nodes
  - No notion of fairness
  - Never switches out running job
- Warning! Start your job as soon as possible.

Counters

- public static enum Counters{MAPPER,REDUCER};

- reporter.incrCounter(Counters.MAPPER,1);
- reporter.incrCounter(Counters.REDUCER,1);

- http://palantir.ics.uci.edu:1755/jobtracker.jsp

Some Performance Tweaks

Split versus StringTokenizer

```
Pattern pattern = java.util.regex.Pattern.compile("[^\\w]+");
String [] responses = pattern.split(text);
```

891 milliseconds

6M Test String

OR?

```
StringTokenizer st = new StringTokenizer(text,
                    " \t\r\n,./?`~!@#$%^&*()-_=+\\|;:'\"<>");
```

0 milliseconds

Which one is better?

```
StringTokenizer st = new StringTokenizer(content,  " ");
while (st.hasMoreTokens()) {
    String token = st.nextToken();
    Text word = new Text(token);
    output.collect(word, docid);
}
```

```
Text word = new Text("");
StringTokenizer st = new StringTokenizer(content,  " ");
while (st.hasMoreTokens()) {
    String token = st.nextToken();
    word.set(token);
    output.collect(word, docid);
}
```

1. Less Garbage Collection.
2. More Cache hits.

Compression?

- Compressing the outputs and intermediate data will often yield huge performance gains
  - Set *mapred.compress.map.output to true to compress map outputs*
- Compression Types *(mapred.output.compression.type) for* SequenceFiles
  - "block" - Group of keys and values are compressed together
  - "record" - Each value is compressed individually
  - Block compression is almost always best
- Compression Codecs *(mapred(.map)?.output.compression.codec)*
  - Default (zlib) - slower, but more compression
  - LZO - faster, but less compression

Valid Terms?

- 14 kilometres
- 1345–1346

Distributed File Cache

- The Distributed Cache facility allows you to transfer files from the distributed file system to the local filesystem (for reading only) of all participating nodes before the beginning of a job.

- Boost efficiency: a node can read the file from its local filesystem.

- DistributedCache.addCacheFile(new URI("/path/to/file_to_distribute"), conf);

More Performance Tweaks

- Hadoop defaults to heap cap of 200 MB
  - Set: mapred.child.java.opts = -Xmx512m
  - 1024 MB / process may also be appropriate

- Use Combiners where possible.

Links

- https://eee.uci.edu/wiki/index.php/INF141_ASS06_01