

CS 378 – Big Data Programming

Lecture 8

Complex “Writable” Types

AVRO

Review

- Assignment 3 - InvertedIndex
- We'll look at implementation details of:
 - Mapper
 - Combiner
 - Reducer
 - Supporting classes
- Other questions/issues?

Hadoop Provided Writables

- We've discussed some Hadoop Writable classes
 - `Text`
 - `LongWritable`
 - `DoubleWritable`
- Hadoop provides many other classes
 - Wrappers for all Java primitive types
 - Some for Hadoop usage (`TaskTrackerStatus`)
 - Others for us to extend (`MapWritable`)

User Defined Writables

- Hadoop provided classes cover commonly used types and data structures
- But we're likely to need more application specific data structures/types
 - For example, `WordStatistics`
- We can define these one by one
 - Must implement the `Writable` interface
 - This will become tedious

Custom Writables

- For our custom `Writable`
- We had to implement `Writable` interface
 - `readFields()`
 - `write()`
- We had to implement `toString()` for text output
- We had to be able to parse in the text representation
- AVRO will implement these things for us

AVRO Example

```
{ "namespace": "com.refactorlabs.cs378.assign4",  
  "type": "record",  
  "name": "WordCountData",  
  "fields": [  
    { "name": "word_count", "type": "long" } ]  
}
```

- How does this get transformed to Java code?
 - Add the schema file to your project (*filename.avsc*)
 - Run maven to force AVRO compile

AVRO Generated Code

- Accessors for the internal data
 - Has methods
 - `hasWordCount ()`
 - ...
 - Get methods
 - `getWordCount ()`
 - ...
- Builder class for constructing instances
 - Above methods
 - Plus set and clear methods

AVRO – Builder Classes

- Why construct instances using the Builder class?
- You AVRO schema contains constraints
 - Value types: enforced by accessors
 - Required vs. optional values (union): checked by build
- Incremental construction
 - For arrays and maps, data can be added incrementally

AVRO I/O

- Text output
 - AVRO text representation is JSON
- Avro container files
 - Binary representation that we can read as input
- The particular format is determined by
 - The types of objects we output
 - The file output format

Assignment 4

- pom.xml provided
 - Added AVRO version, dependency
 - Instructions to compile AVRO schema definitions
- Example use of AVRO: WordCountA.java
 - Classpath management
 - AvroJob versus Job
 - AvroValue<>
- All files on Canvas / Files / Assignment 4

Assignment 4

- Implement WordStatistics using an Avro schema
 - Use the Avro schema in WordCountA as an example
- For each word calculate (like assignment 2):
 - *Mean, variance, min, max* of the occurrences of the word in those paragraphs where the word appears
 - Also compute these stats for paragraph length
 - All in one pass over the data

Assignment 4

- Implement an AVRO object for WordStatistics data
 - Call it `WordStatisticsData`
 - Mapper output:
 - `Text, AvroValue<WordStatisticsData>`
 - Reducer output:
 - `Text, AvroValue<WordStatisticsData>`
- See code in `WordCountA`
 - Output file format: `TextOutputFormat`
 - Set JAR to beginning of classpath
 - Calls using `AvroJob` to define the Avro schema