Assignment-3

AIM: Locate dataset (e.g., sample_weather.txt) for working on weather data which reads the text input files and finds average for temperature, dew point and wind speed.

Let us summarize how Hadoop works step by step:

- Input data is broken into blocks of size 128 Mb and then blocks are moved to different nodes.
- Once all the blocks of the data are stored on data-nodes, the user can process the data.
- Resource Manager then schedules the program (submitted by the user) on individual nodes.
- Once all the nodes process the data, the output is written back to HDFS.

Weather Analyse (average Temperature, dew point, wind speed)

Weather.java

```
import java.io.IOException;
import java.util.ArrayList;
import java.util.Iterator;
import java.util.List;
import java.util.StringTokenizer;
import org.apache.hadoop.conf.Configuration;
import org.apache.hadoop.conf.Configured;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.LongWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.FileInputFormat;
import org.apache.hadoop.mapred.FileOutputFormat;
import org.apache.hadoop.mapred.JobClient;
import org.apache.hadoop.mapred.JobConf;
import org.apache.hadoop.mapred.KeyValueTextInputFormat;
import org.apache.hadoop.mapred.MapReduceBase;
import org.apache.hadoop.mapred.Mapper;
import org.apache.hadoop.mapred.OutputCollector;
import org.apache.hadoop.mapred.Reducer;
import org.apache.hadoop.mapred.Reporter;
import org.apache.hadoop.util.*;
/**
 * This is an Hadoop Map/Reduce application for Working on weather data It reads
 * the text input files, breaks each line into stations weather data and finds
 * average for temperature, dew point , wind speed. The output is a locally
 * sorted list of stations and its 12 attribute vector of average temp , dew ,
 * wind speed of 4 sections for each month.
*/
public class Weather extends Configured implements Tool {
        final long DEFAULT_SPLIT_SIZE = 128 * 1024 * 1024;
        /**
         * Map Class for Job 1
         * For each line of input, emits key value pair with
         * station_yearmonth_sectionno as key and 3 attribute vector with
         * temperature , dew point , wind speed as value.Map method will strip the
         * day and hour from field and replace it with section no (
         * <b>station_yearmonth_sectionno</b>, <b><temperature,dew point , wind
 * speed></b>).
 */
public static class MapClass extends MapReduceBase
			implements Mapper<LongWritable, Text, Text, Text> {
		private Text word = new Text();
		private Text values = new Text();
		public void map(LongWritable key, Text value,
						OutputCollector<Text, Text> output,
						Reporter reporter) throws IOException {
			String line = value.toString();
			StringTokenizer itr = new StringTokenizer(line);
			int counter = 0;
			String key_out = null;
			String value_str = null;
			boolean skip = false;
			loop:while (itr.hasMoreTokens() && counter<13) {
				String str = itr.nextToken();
				switch (counter) {
				case 0:
					key_out = str;
					if(str.contains("STN")){//Ignoring rows where stationid is all 9
						skip = true;
						break loop;
					}else{
						break;
					}
				case 2:
					int hour = Integer.valueOf(str.substring(str.lastIndexOf("_")+1, str.length()));
					str = str.substring(4,str.lastIndexOf("_")-2);
					if(hour>4 && hour<=10){
						str = str.concat("_section1");
					}else if(hour>10 && hour<=16){
						str = str.concat("_section2");
					}else if(hour>16 && hour<=22){
						str = str.concat("_section3");
					} else{ str = str.concat("_section4");
					}

					key_out = key_out.concat("_").concat(str);
					break;
				case 3://Temperature
					if(str.equals("9999.9")){//Ignoring rows temperature is all 9
						skip = true;
						break loop;
					}else{
						value_str = str.concat(" ");
						break;
					}
				case 4://Dew point
					if(str.equals("9999.9")){//Ignoring rows where dewpoint all 9
						skip = true;
						break loop;
```

```java
                }else{
                    value_str = value_str.concat(str).concat(" ");
                    break;
                }
            case 12://Wind speed
                if(str.equals("999.9")){//Ignoring rows wind speed is all 9
                    skip = true;
                    break loop;
                }else{ value_str = value_str.concat(str).concat(" ");
                    break;
                }
            default: break;
            }
            counter++;
        }
        if(!skip){
            word.set(key_out);
            values.set(value_str);
            output.collect(word, values);
        }
    }
}
/**
 * Reducer Class for Job 1
 * A reducer class that just emits 3 attribute vector with average
 * temperature , dew point , wind speed for each of the section of the month for each input
 */
public static class Reduce extends MapReduceBase
        implements Reducer<Text, Text, Text, Text> {
    private Text value_out_text = new Text();
    public void reduce(Text key, Iterator<Text> values,
            OutputCollector<Text, Text> output, Reporter reporter) throws IOException {
        double sum_temp = 0;
        double sum_dew = 0;
        double sum_wind = 0;
        int count = 0;

        while (values.hasNext()) {
            String str = values.next().toString();
            StringTokenizer itr = new StringTokenizer(str);
            int count_vector = 0;
            while (itr.hasMoreTokens()) {
                String nextToken = itr.nextToken(" ");
                if(count_vector==0){
                    sum_temp += Double.valueOf(nextToken);
                }
                if(count_vector==1){
                    sum_dew += Double.valueOf(nextToken);
                }
                if(count_vector==2){
                    sum_wind += Double.valueOf(nextToken);
                }
```

```
					count_vector++;
				}
				count++;
			}
			double avg_tmp = sum_temp / count;
			double avg_dew = sum_dew / count;
			double avg_wind = sum_wind / count;
			System.out.println(key.toString()+" count is "+count+" sum of temp is "+sum_temp+" sum of
dew is "+sum_dew+" sum of wind is "+sum_wind+"\n");
			String		value_out		=		String.valueOf(avg_tmp).concat("
").concat(String.valueOf(avg_dew)).concat(" ").concat(String.valueOf(avg_wind));
			value_out_text.set(value_out);
			output.collect(key, value_out_text);
		}
	}
	static int printUsage() {
		System.out.println("weather  [-m  <maps>]  [-r  <reduces>]  <job_1  input>  <job_1  output>  <job_2
output>");
		ToolRunner.printGenericCommandUsage(System.out);
		return -1;
	}
	/**
	 * The main driver for weather map/reduce program.
	 * Invoke this method to submit the map/reduce job.
	 * @throws IOException When there is communication problems with the job tracker.
	 */
	public int run(String[] args) throws Exception {
		Configuration config = getConf();
		// We need to lower input block size by factor of two
		JobConf conf = new JobConf(config, Weather.class);
		conf.setJobName("Weather Job1");

		// the keys are words (strings)
		conf.setOutputKeyClass(Text.class);
		// the values are counts (ints)
		conf.setOutputValueClass(Text.class);

		conf.setMapOutputKeyClass(Text.class);
		conf.setMapOutputValueClass(Text.class);
		conf.setMapperClass(MapClass.class);
		//conf.setCombinerClass(Combiner.class);
		conf.setReducerClass(Reduce.class);
		List<String> other_args = new ArrayList<String>();
		for(int i=0; i < args.length; ++i) {
			try {
				if ("-m".equals(args[i])) {
					conf.setNumMapTasks(Integer.parseInt(args[++i]));
				} else if ("-r".equals(args[i])) {
					conf.setNumReduceTasks(Integer.parseInt(args[++i]));
				} else {
					other_args.add(args[i]);
				}
```

```
                    } catch (NumberFormatException except) {
                            System.out.println("ERROR: Integer expected instead of " + args[i]);
                            return printUsage();
                    } catch (ArrayIndexOutOfBoundsException except) {
                            System.out.println("ERROR: Required parameter missing from " +
                                    args[i-1]);
                            return printUsage();
                    }
            }
            // Make sure there are exactly 2 parameters left.
            FileInputFormat.setInputPaths(conf, other_args.get(0));
            FileOutputFormat.setOutputPath(conf, new Path(other_args.get(1)));
            JobClient.runJob(conf);
            return 0;
    }
    public static void main(String[] args) throws Exception {
            int res = ToolRunner.run(new Configuration(), new Weather(), args);
            System.exit(res);
    }
}
```

Input: sample_weather.txt (sample)

```
690190 13910 20060201_0 51.75    33.0 24 1006.3 24  943.9 24  15.0 24  10.7 24  22.0  28.9  0.00I 999.9 000000
690190 13910 20060201_1 54.74    33.0 24 1006.3 24  943.9 24  15.0 24  10.7 24  22.0  28.9  0.00I 999.9 00000
690190 13910 20060201_2 50.59    33.0 24 1006.3 24  943.9 24  15.0 24  10.7 24  22.0  28.9  0.00I 999.9 00000
690190 13910 20060201_3 51.67    33.0 24 1006.3 24  943.9 24  15.0 24  10.7 24  22.0  28.9  0.00I 999.9 000000
690190 13910 20060201_4 65.67    33.0 24 1006.3 24  943.9 24  15.0 24  10.7 24  22.0  28.9  0.00I 999.9 000000
690190 13910 20060201_5 55.37    33.0 24 1006.3 24  943.9 24  15.0 24  10.7 24  22.0  28.9  0.00I 999.9 000000
690190 13910 20060201_6 49.26    33.0 24 1006.3 24  943.9 24  15.0 24  10.7 24  22.0  28.9  0.00I 999.9 000000
690190 13910 20060201_7 55.44    33.0 24 1006.3 24  943.9 24  15.0 24  10.7 24  22.0  28.9  0.00I 999.9 000000
690190 13910 20060201_8 64.05    33.0 24 1006.3 24  943.9 24  15.0 24  10.7 24  22.0  28.9  0.00I 999.9 000000
```

Output: part-00000.txt (on Hadoop)

```
690190_02_section1  53.87166666666666 25.899999999999995 7.774999999999998
690190_02_section2  54.76125000000001 25.900000000000006 7.774999999999999
690190_02_section3  53.25041666666667 25.899999999999995 7.774999999999996
690190_02_section4  52.44708333333333 25.900000000000006 7.774999999999999
```

Weather Data Analysis Steps to run:

26. Starting Hadoop

    $ start-all.sh

27. Made A folder “WeatherAssi” and write Weather.java code.
28. Create new folder for input data.
29. Add input text file in the input data folder.
30. Create new folder to hold java class files.
31. Set HADOOP_CLASSPATH environment variable.

    $ export HADOOP_CLASSPATH=$(hadoop classpath)

32. Create a directory on HDFS

$ hdfs dfs -mkdir /WeatherTut

$ hdfs dfs -mkdir /WeatherTut/Input

33. Checking on localhost:9870

34. Upload the input file (device) to that directory.

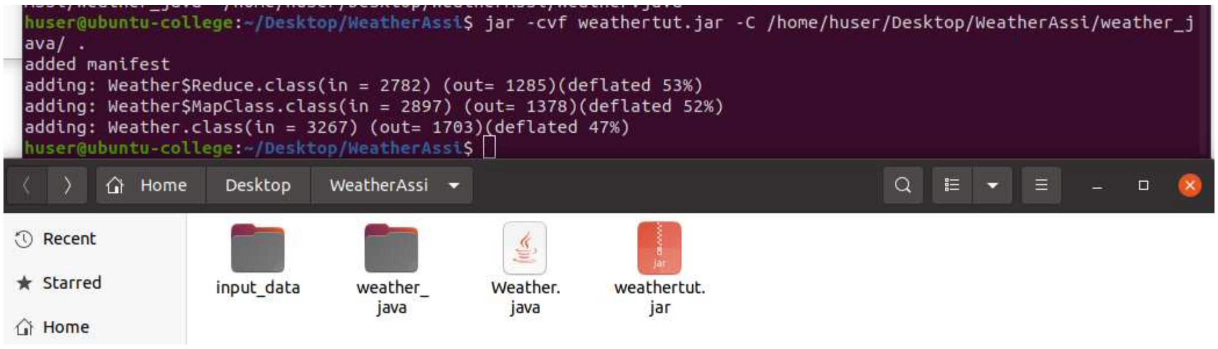
$ hdfs dfs -put input_data/sample_wheater.txt /WeatherTuT/Input

35. Compile the java code:

$ javac -classpath $(HADOOP_CLASSPATH) -d '/home/huser/Desktop/WeatherAssi/ weather_java' /home/huser/Desktop/WeatherAssi/Weather.java

36. Creation .jar file of classes:

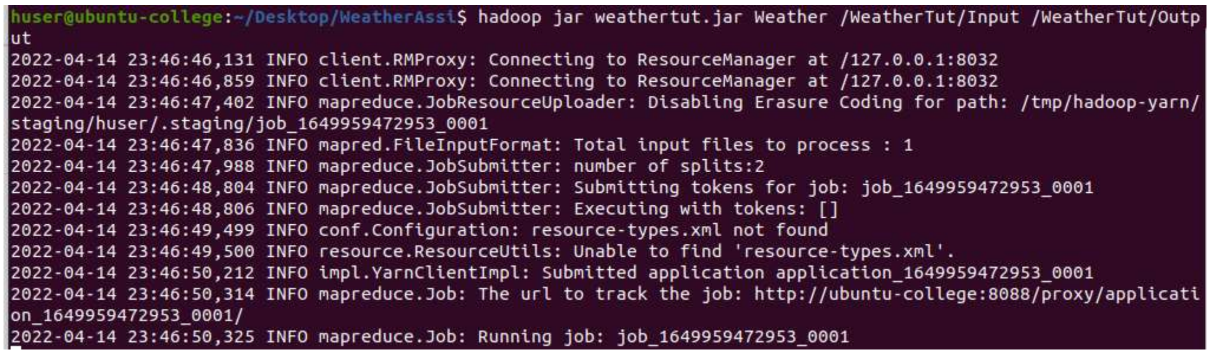
$ jar -cvf weathertut.jar -C /home/huser/Desktop/WeatherAssi/weather_java/ .



```
huser@ubuntu-college:~/Desktop/WeatherAssi$ jar -cvf weathertut.jar -C /home/huser/Desktop/WeatherAssi/weather_j
ava/ .
added manifest
adding: Weather$Reduce.class(in = 2782) (out= 1285)(deflated 53%)
adding: Weather$MapClass.class(in = 2897) (out= 1378)(deflated 52%)
adding: Weather.class(in = 3267) (out= 1703)(deflated 47%)
huser@ubuntu-college:~/Desktop/WeatherAssi$
```

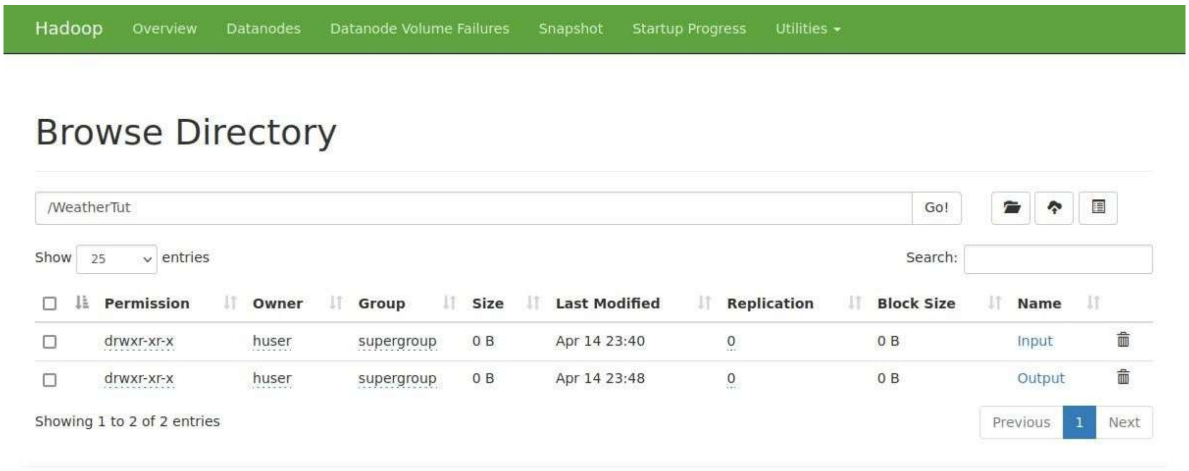
37. Running the jar file on Hadoop

$ hadoop jar weather.jar Weather /WeatherTut/Input /WeatherTut/Ouput



```
huser@ubuntu-college:~/Desktop/WeatherAssi$ hadoop jar weathertut.jar Weather /WeatherTut/Input /WeatherTut/Outp
ut
2022-04-14 23:46:46,131 INFO client.RMProxy: Connecting to ResourceManager at /127.0.0.1:8032
2022-04-14 23:46:46,859 INFO client.RMProxy: Connecting to ResourceManager at /127.0.0.1:8032
2022-04-14 23:46:47,402 INFO mapreduce.JobResourceUploader: Disabling Erasure Coding for path: /tmp/hadoop-yarn/
staging/huser/.staging/job_1649959472953_0001
2022-04-14 23:46:47,836 INFO mapred.FileInputFormat: Total input files to process : 1
2022-04-14 23:46:47,988 INFO mapreduce.JobSubmitter: number of splits:2
2022-04-14 23:46:48,804 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1649959472953_0001
2022-04-14 23:46:48,806 INFO mapreduce.JobSubmitter: Executing with tokens: []
2022-04-14 23:46:49,499 INFO conf.Configuration: resource-types.xml not found
2022-04-14 23:46:49,500 INFO resource.ResourceUtils: Unable to find 'resource-types.xml'.
2022-04-14 23:46:50,212 INFO impl.YarnClientImpl: Submitted application application_1649959472953_0001
2022-04-14 23:46:50,314 INFO mapreduce.Job: The url to track the job: http://ubuntu-college:8088/proxy/applicati
on_1649959472953_0001/
2022-04-14 23:46:50,325 INFO mapreduce.Job: Running job: job_1649959472953_0001
```

38. Check output on localhost:9870 /localhost:50070



Browse Directory

/WeatherTut

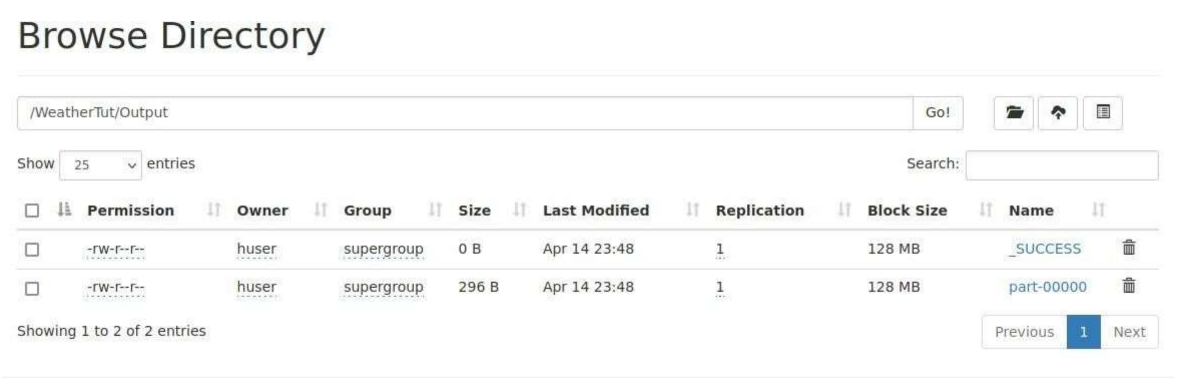
Show 25 entries

Search:

	Permission	Owner	Group	Size	Last Modified	Replication	Block Size	Name
☐	drwxr-xr-x	huser	supergroup	0 B	Apr 14 23:40	0	0 B	Input
☐	drwxr-xr-x	huser	supergroup	0 B	Apr 14 23:48	0	0 B	Output

Showing 1 to 2 of 2 entries

Previous 1 Next



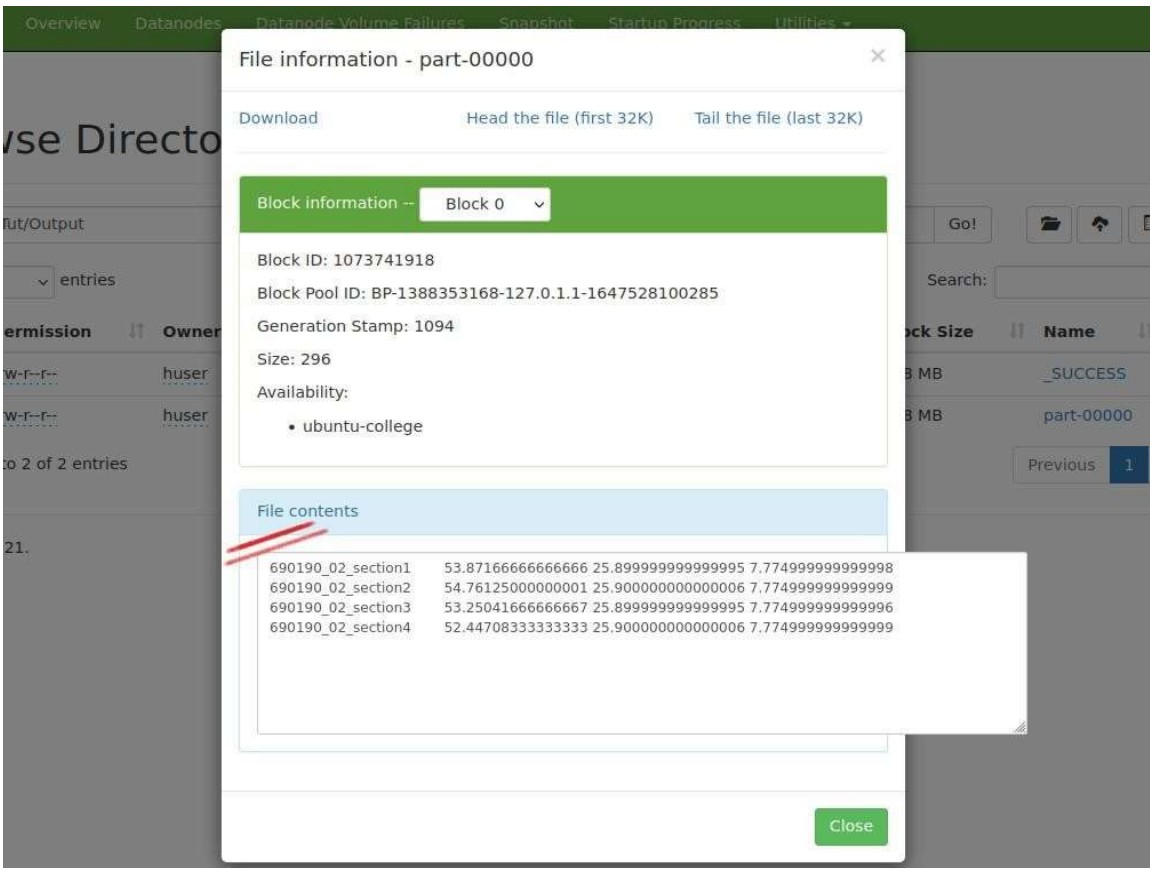
Browse Directory

/WeatherTut/Output

Show 25 entries

Permission	Owner	Group	Size	Last Modified	Replication	Block Size	Name
-rw-r--r--	huser	supergroup	0 B	Apr 14 23:48	1	128 MB	_SUCCESS
-rw-r--r--	huser	supergroup	296 B	Apr 14 23:48	1	128 MB	part-00000

Showing 1 to 2 of 2 entries



File information - part-00000

Download | Head the file (first 32K) | Tail the file (last 32K)

Block information -- Block 0

Block ID: 1073741918

Block Pool ID: BP-1388353168-127.0.1.1-1647528100285

Generation Stamp: 1094

Size: 296

Availability:

- ubuntu-college

File contents

```
690190_02_section1	53.87166666666666 25.899999999999995 7.774999999999998
690190_02_section2	54.76125000000001 25.900000000000006 7.774999999999999
690190_02_section3	53.25041666666667 25.899999999999995 7.774999999999996
690190_02_section4	52.44708333333333 25.900000000000006 7.774999999999999
```

39. Stop Hadoop services:

$ stop-all.sh