

```

        job.setOutputValueClass(IntWritable.class);

        System.exit(job.waitForCompletion(true) ? 0 : 1);
    }
}

```

## Running a Distributed MapReduce Job

The same program will run, without alteration, on a full dataset. This is the point of MapReduce: it scales to the size of your data and the size of your hardware. Here's one data point: on a 10-node EC2 cluster running High-CPU Extra Large instances, the program took six minutes to run.<sup>2</sup>

We'll go through the mechanics of running programs on a cluster in [Chapter 6](#).

## Hadoop Streaming

Hadoop provides an API to MapReduce that allows you to write your map and reduce functions in languages other than Java. *Hadoop Streaming* uses Unix standard streams as the interface between Hadoop and your program, so you can use any language that can read standard input and write to standard output to write your MapReduce program.<sup>3</sup>

Streaming is naturally suited for text processing. Map input data is passed over standard input to your map function, which processes it line by line and writes lines to standard output. A map output key-value pair is written as a single tab-delimited line. Input to the reduce function is in the same format—a tab-separated key-value pair—passed over standard input. The reduce function reads lines from standard input, which the framework guarantees are sorted by key, and writes its results to standard output.

Let's illustrate this by rewriting our MapReduce program for finding maximum temperatures by year in Streaming.

## Ruby

The map function can be expressed in Ruby as shown in [Example 2-7](#).

2. This is a factor of seven faster than the serial run on one machine using *awk*. The main reason it wasn't proportionately faster is because the input data wasn't evenly partitioned. For convenience, the input files were gzipped by year, resulting in large files for later years in the dataset, when the number of weather records was much higher.
3. Hadoop Pipes is an alternative to Streaming for C++ programmers. It uses sockets to communicate with the process running the C++ map or reduce function.