Big data: architectures and data analytics

Multiple inputs

Multiple inputs

- In some applications data are read from two or more datasets
  - The datasets could have different formats
- Hadoop allows reading data from multiple inputs (multiple datasets) with different formats
  - One different mapper for each input dataset must be specified
  - However, the key-value pairs emitted by the mappers must be consistent

Multiple inputs

- Example of a use case
  - Input data collected from different sensors
  - All sensors measure the same "measure"
  - But sensors developed by different vendors use a different data format to store the gathered data/measurements

Multiple inputs

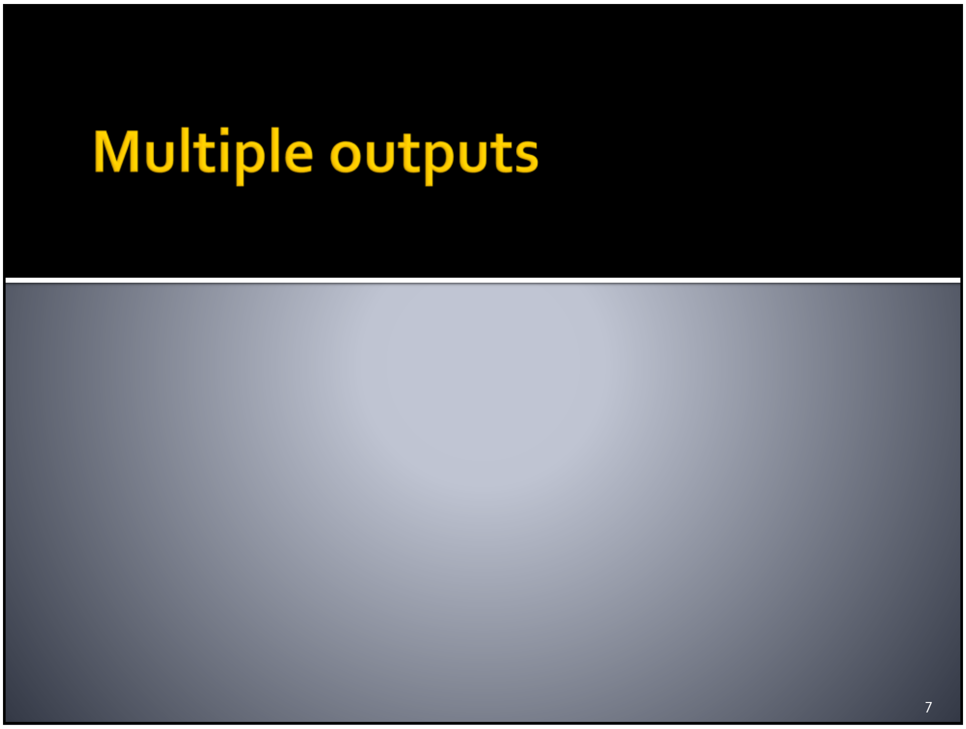
- In the driver
  - Use the addInputPath method of the MultipleInputs class multiple times to
    - Add one input path at a time
    - Specify the input format class
    - Specify the Mapper class associated with the specified input path

Multiple inputs

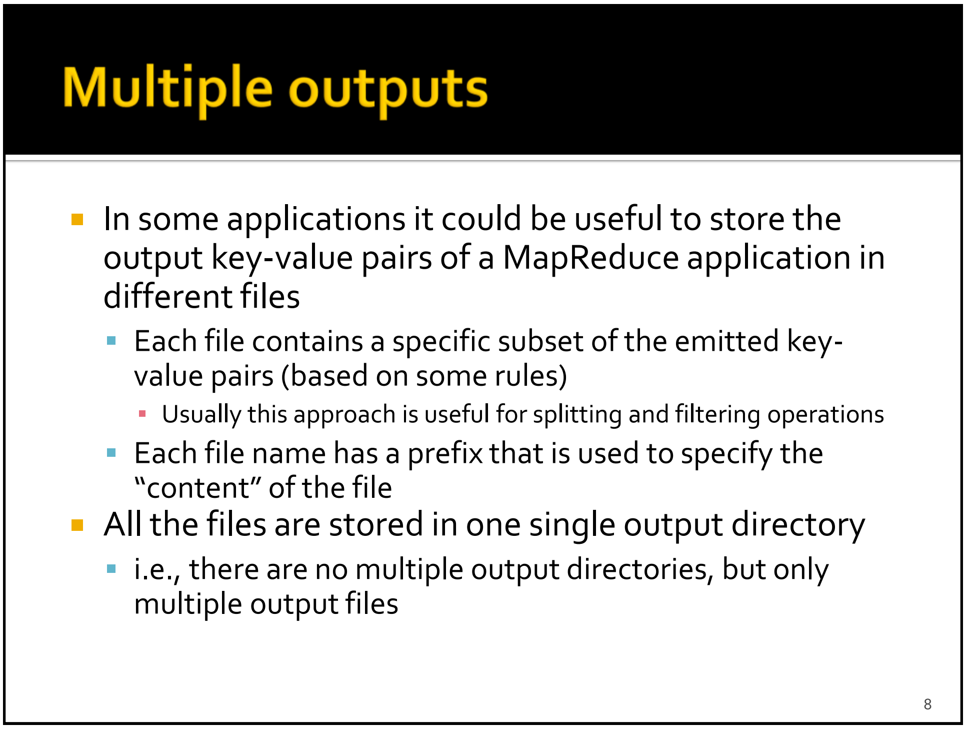
- E.g.,

```
MultipleInputs.addInputPath(job, new Path(args[1]),
TextInputFormat.class, Mapper1.class);
MultipleInputs.addInputPath(job, new Path(args[2]),
TextInputFormat.class, Mapper2.class);
```

  - Specify two input paths (args[1] and args[2])
  - The data of both paths are read by using the TextInputFormat class
  - The Mapper1 class is the class used to manage the input key-value pairs associated with the first path
  - The Mapper2 class is used to manage the input key-value pairs associated with the second path

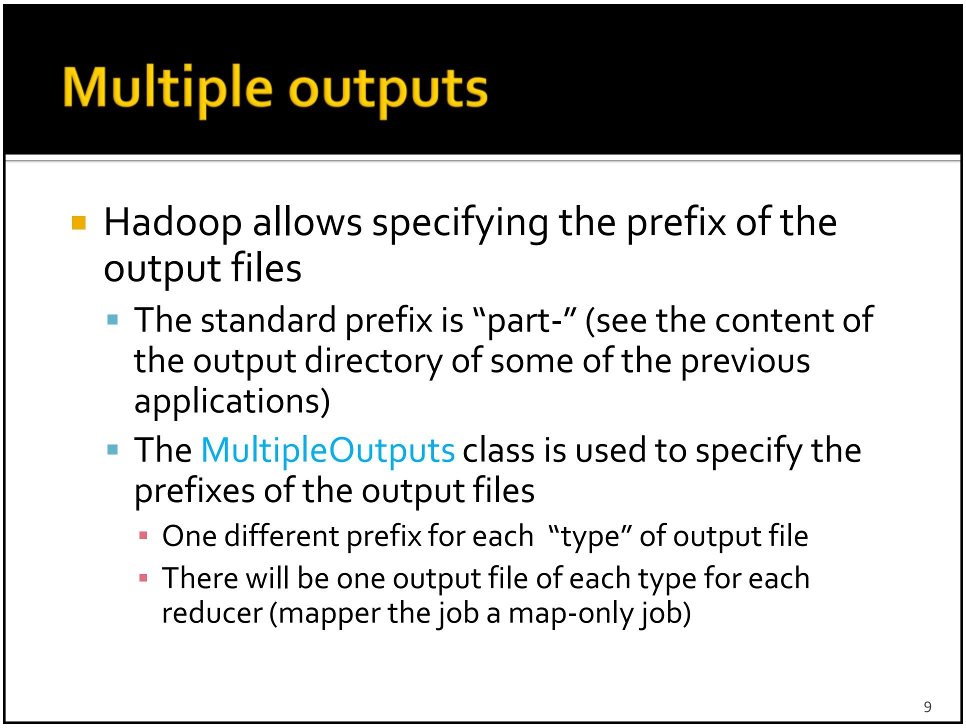


Multiple outputs



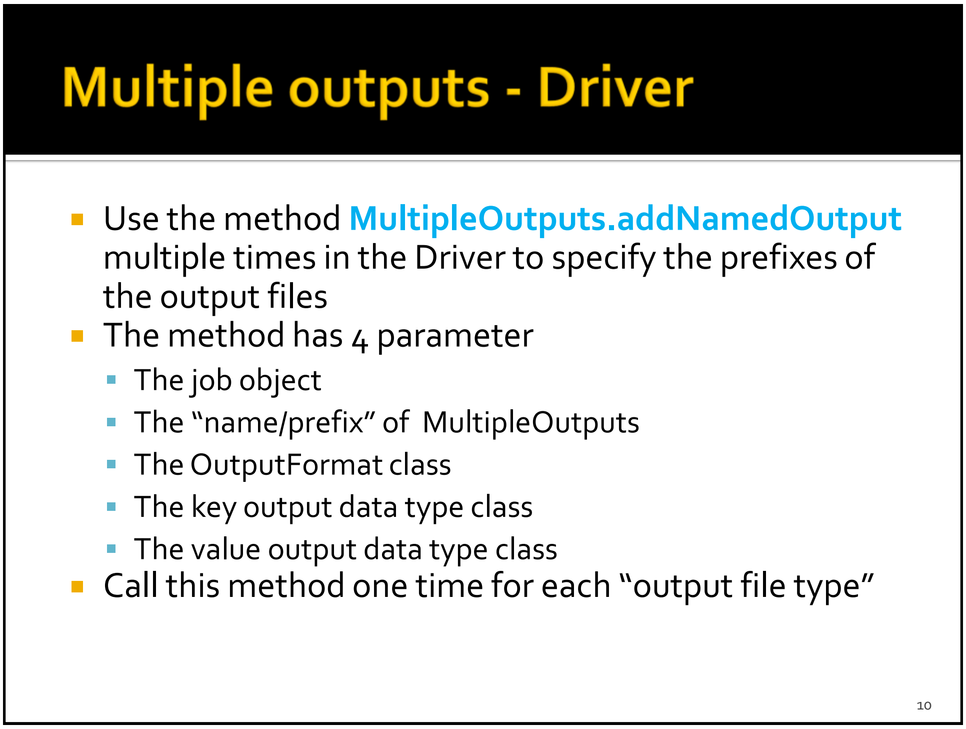
Multiple outputs

- In some applications it could be useful to store the output key-value pairs of a MapReduce application in different files
  - Each file contains a specific subset of the emitted key-value pairs (based on some rules)
    - Usually this approach is useful for splitting and filtering operations
  - Each file name has a prefix that is used to specify the "content" of the file
- All the files are stored in one single output directory
  - i.e., there are no multiple output directories, but only multiple output files



Multiple outputs

- Hadoop allows specifying the prefix of the output files
  - The standard prefix is "part-" (see the content of the output directory of some of the previous applications)
  - The MultipleOutputs class is used to specify the prefixes of the output files
    - One different prefix for each "type" of output file
    - There will be one output file of each type for each reducer (mapper the job a map-only job)



Multiple outputs - Driver

- Use the method **MultipleOutputs.addNamedOutput** multiple times in the Driver to specify the prefixes of the output files
- The method has 4 parameter
  - The job object
  - The "name/prefix" of MultipleOutputs
  - The OutputFormat class
  - The key output data type class
  - The value output data type class
- Call this method one time for each "output file type"

Multiple outputs - Driver

- E.g.,
  MultipleOutputs.addNamedOutput(job, "hightemp", TextOutputFormat.class, Text.class, NullWritable.class);
  MultipleOutputs.addNamedOutput(job, "normaltemp", TextOutputFormat.class, Text.class, NullWritable.class);
- This example defines two types of output files
  - The first type of output files while have the prefix “hightemp”
  - The second type of output files while have the prefix “normaltemp”

Multiple outputs – Map-only example

- Define a private MultipleOutputs variable in the mapper if the job is a map-only job (in the reducer otherwise)
  - E.g.,
    - private MultipleOutputs<Text, NullWritable> mos = null;
- Create an instance of the MultipleOutputs class in the setup method of the mapper (or in the reducer)
  - E.g.,
    - mos = new MultipleOutputs<Text, NullWritable>(context);

Multiple outputs – Map-only example

- Use the write method of the MultipleOutputs object in the map method (or in the reduce method) to write the key-value pairs in the file of interest
  - E.g.,
    - mos.write("hightemp", value, NullWritable.get());
      - This example writes the current key-value pair in a file with the prefix "hightemp-"
    - mos.write("normaltemp", value, NullWritable.get());
      - This example writes the current key-value pair in a file with the prefix "normaltemp-"

Multiple outputs – Map-only example

- Close the MultipleOutputs object in the cleanup method of the mapper (or of the reducer)
  - E.g.,
    - mos.close();