

Transformations and Actions on Pair RDDs

Big Data Analysis with Scala and Spark

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Some interesting Pair RDDs operations

Important operations defined on Pair RDDs:
(But not available on regular RDDs)

Transformations

- ▶ groupByKey
- ▶ reduceByKey
- ▶ mapValues
- ▶ keys
- ▶ join
- ▶ leftOuterJoin/rightOuterJoin

Action

- ▶ countByKey

Pair RDD Transformation: `groupByKey`

Recall `groupBy` from Scala collections.

Pair RDD Transformation: ~~groupByKey~~

Recall groupBy from Scala collections.

```
def groupBy[K](f: A => K): Map[K, Traversable[A]]
```

Partitions this traversable collection into a map of traversable collections according to some discriminator function.

In English: Breaks up a collection into two or more collections according to a function that you pass to it. Result of the function is the key, the collection of results that return that key when the function is applied to it. Returns a Map mapping computed keys to collections of corresponding values.

Pair RDD Transformation: groupByKey

Recall groupBy from Scala collections.

```
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```

Example:

Let's group the below list of ages into "child", "adult", and "senior" categories.

```
val ages = List(2, 52, 44, 23, 17, 14, 12, 82, 51, 64)
val grouped = ages.groupBy { age =>
  if (age >= 18 && age < 65) "adult"
  else if (age < 18) "child"
  else "senior"
}
// grouped: scala.collection.immutable.Map[String,List[Int]] =
// Map(senior -> List(82), adult -> List(52, 44, 23, 51, 64),
// child -> List(2, 17, 14, 12))
```

Pair RDD Transformation: groupByKey

Recall groupBy from Scala collections. groupByKey can be thought of as a groupBy on Pair RDDs that is specialized on grouping all values that have the same key. As a result, it takes no argument.

```
def groupByKey(): RDD[(K, Iterable[V])]
```

Pair RDD Transformation: groupByKey

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```
def groupByKey(): RDD[(K, Iterable[V])]
```

Example:

```
case class Event(organizer: String, name: String, budget: Int)
val eventsRdd = sc.parallelize(...)
                      .map(event => (event.organizer, event.budget))

val groupedRdd = eventsRdd.groupByKey()
```

Here the key is organizer. What does this call do?

Pair RDD Transformation: groupByKey

Example:

```
case class Event(organizer: String, name: String, budget: Int)
val eventsRdd = sc.parallelize(...)
                    .map(event => (event.organizer, event.budget))
```

```
val groupedRdd = eventsRdd.groupByKey()
```

```
// TRICK QUESTION! As-is, it "does" nothing. It returns an unevaluated RDD
```

```
groupedRdd.collect().foreach(println)
// (Prime Sound,CompactBuffer(42000))
// (Sportorg,CompactBuffer(23000, 12000, 1400))
// ...
```


Pair RDD Transformation: reduceByKey

Conceptually, reduceByKey can be thought of as a combination of groupByKey and reduce-ing on all the values per key. It's more efficient though, than using each separately. (We'll see why later.)

```
def reduceByKey(func: (V, V) => V): RDD[(K, V)]
```

Pair RDD Transformation: reduceByKey

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```
def reduceByKey(func: (V, V) => V): RDD[(K, V)]
```

Example: Let's use eventsRdd from the previous example to calculate the total budget per organizer of all of their organized events.

```
case class Event(organizer: String, name: String, budget: Int)
val eventsRdd = sc.parallelize(...).map(event => (event.organizer, event.budget))

val budgetsRdd = ...
```

Pair RDD Transformation: reduceByKey

Example: Let's use eventsRdd from the previous example to calculate the total budget per organizer of all of their organized events.

```
case class Event(organizer: String, name: String, budget: Int)
val eventsRdd = sc.parallelize(...)
                    .map(event => (event.organizer, event.budget))
```

```
val budgetsRdd = eventsRdd.reduceByKey(_+_)
```

```
reducedRdd.collect().foreach(println)
// (Prime Sound,42000)
// (Sportorg,36400)
// (Innotech,320000)
// (Association Balélec,50000)
```

Pair RDD Transformation: mapValues and Action: countByKey

mapValues (def mapValues[U](f: V => U): RDD[(K, U)]) can be thought of as a short-hand for:

```
rdd.map { case (x, y): (x, func(y)) }
```

That is, it simply applies a function to only the values in a Pair RDD.

countByKey (def countByKey(): Map[K, Long]) simply counts the number of elements per key in a Pair RDD, returning a normal Scala Map (remember, it's an action!) mapping from keys to counts.

Pair RDD Transformation: mapValues and Action: countByKey

Example: we can use each of these operations to compute the average budget per event organizer, if possible.

```
// Calculate a pair (as a key's value) containing (budget, #events)
val intermediate = ??? // Can we use countByKey?
```

Pair RDD Transformation: mapValues and Action: countByKey

Example: we can use each of these operations to compute the average budget per event organizer, if possible.

```
// Calculate a pair (as a key's value) containing (budget, #events)
val intermediate =
  eventsRdd.mapValues(b => (b, 1))
             .reduceByKey()
```

$(\underset{K}{org}, \underset{V}{budget}) \rightarrow \underline{(org, (budget, 1))}$

Result should look like:

$(org, (total\ Budget, total\ \# events\ organized))$

Pair RDD Transformation: mapValues and Action: countByKey

Example: we can use each of these operations to compute the average budget per event organizer, if possible.

```
// Calculate a pair (as a key's value) containing (budget, #events)
val intermediate =
  eventsRdd.mapValues(b => (b, 1))
               .reduceByKey((v1, v2) => (v1._1 + v2._1, v1._2 + v2._2))
// intermediate: RDD[(String, (Int, Int))]
```

(budget, 1)

budgets

total # events

Pair RDD Transformation: mapValues and Action: countByKey

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// intermediate: RDD[(String, (Int, Int))]

val avgBudgets = ???
```


Pair RDD Transformation: mapValues and Action: countByKey

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```
// Calculate a pair (as a key's value) containing (budget, #events)
val intermediate =
  eventsRdd.mapValues(b => (b, 1))
              .reduceByKey((v1, v2) => (v1._1 + v2._1, v1._2 + v2._2))
// intermediate: RDD[(String, (Int, Int))]

val avgBudgets = intermediate.mapValues {
  case (budget, numberOfEvents) => budget / numberOfEvents
}
avgBudgets.collect().foreach(println)
// (Prime Sound,42000)
// (Sportorg,12133)
// (Innotech,106666)
// (Association Balélec,50000)
```

Pair RDD Transformation: keys

keys (def keys: RDD[K]) Return an RDD with the keys of each tuple.

Note: this method is a transformation and thus returns an RDD because the number of keys in a Pair RDD may be unbounded. It's possible for every value to have a unique key, and thus it may not be possible to collect all keys at one node.

Pair RDD Transformation: keys

keys (def keys: RDD[K]) Return an RDD with the keys of each tuple.

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Example: we can count the number of unique visitors to a website using the keys transformation.

```
case class Visitor(ip: String, timestamp: String, duration: String)
val visits: RDD[Visitor] = sc.textfile(...).map(v => (v.ip, v.duration))
val numUniqueVisits = ???
```

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case class Visitor(ip: String, timestamp: String, duration: String)
val visits: RDD[Visitor] = sc.textfile(...)
                             .map(v => (v.ip, v.duration))
val numUniqueVisits = visits.keys.distinct().count()
// numUniqueVisits: Long = 3391
```

PairRDDFunctions

For a list of all available specialized Pair RDD operations, see the Spark API page for PairRDDFunctions (ScalaDoc):

<http://spark.apache.org/docs/latest/api/scala/index.html#org.apache.spark.rdd.PairRDDFunctions>

 org.apache.spark.rdd

PairRDDFunctions

Related Doc: [package rdd](#)

`class PairRDDFunctions[K, V] extends Logging with Serializable`

Extra functions available on RDDs of (key, value) pairs through an implicit conversion.

Source [PairRDDFunctions.scala](#)

► Linear Supertypes

Ordering

Alphabetic By Inheritance

Inherited

PairRDDFunctions Serializable Serializable Logging AnyRef Any

Hide All

Show All

Visibility

Public All

Instance Constructors

```
new PairRDDFunctions(self: RDD[(K, V)])(implicit kt: ClassTag[K], vt: ClassTag[V], ord: Ordering[K] = null)
```

Value Members

►

```
def aggregateByKey[U](zeroValue: U)(seqOp: (U, V) => U, combOp: (U, U) => U)(implicit arg0: ClassTag[U]): RDD[(K, U)]
```

Aggregate the values of each key, using given combine functions and a neutral "zero value".

►

```
def aggregateByKey[U](zeroValue: U, numPartitions: Int)(seqOp: (U, V) => U, combOp: (U, U) => U)(implicit arg0: ClassTag[U]): RDD[(K, U)]
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