Simple Tutorial

CS-562

Introduction to data analysis using Apache Spark

What is Scala?

- Scala is a mixture. It is the place where 2 world connect:
    - Object oriented programming
    - Functional Programming

- This mixture is the strength of Scala.
- We can say that Scala is a better version of Java.

Java vs Scala WordCount

```java
public class WordCountJava {
   public static void main(String[] args) {
       StringTokenizer st
               = new StringTokenizer(args[0]);
       Map<String, Integer> map =
               new HashMap<String, Integer>();
       while (st.hasMoreTokens()) {
           String word = st.nextToken();
           Integer count = map.get(word);
           if (count == null)
               map.put(word, 1);
           else
               map.put(word, count + 1);
       }
       System.out.println(map);
   }
}
```


```scala
object WordCountScala extends App {
 println(
   args(0)
   .split(" ")
   .groupBy(x => x)
   .map(t => t._1 -> t._2.length))
}
```

```
> runMain WordCountJava "a b a c a b"
[info] Running WordCountJava a b a c a b
{a=3, b=2, c=1}
```

```
> runMain WordCountScala "a b a c a b"
[info] Running WordCountScala a b a c a b
Map(b -> 2, a -> 3, c -> 1)
```

var vs val

- Var -> **Var** - iable

- Val -> **V**ariable + Fin**al**

Functions Vs Methods

- Function is a group of statements that perform a task

But what is the difference of a method and a function?

Method: a function, which is defined as a member of some object

Function: a group of statements that perform a task

Load our data

- sc.parallelize()

Parallelized collections are created by calling SparkContext's parallelize method on an existing collection.

The elements of the collection are copied to form a distributed dataset that can be operated on in parallel.

Lists & Arrays

- Scala Lists are quite similar to arrays

- All the elements of a list have the same type but…

- First, lists are immutable, which means elements of a list cannot be changed by assignment.

- Second, lists represent a linked list whereas arrays are flat.

  example: `val nums: List[Int] = List(1, 2, 3, 4)`

Zip & ZipWithIndex

Zip

Returns a list formed from this list and another iterable collection by combining corresponding elements in pairs.

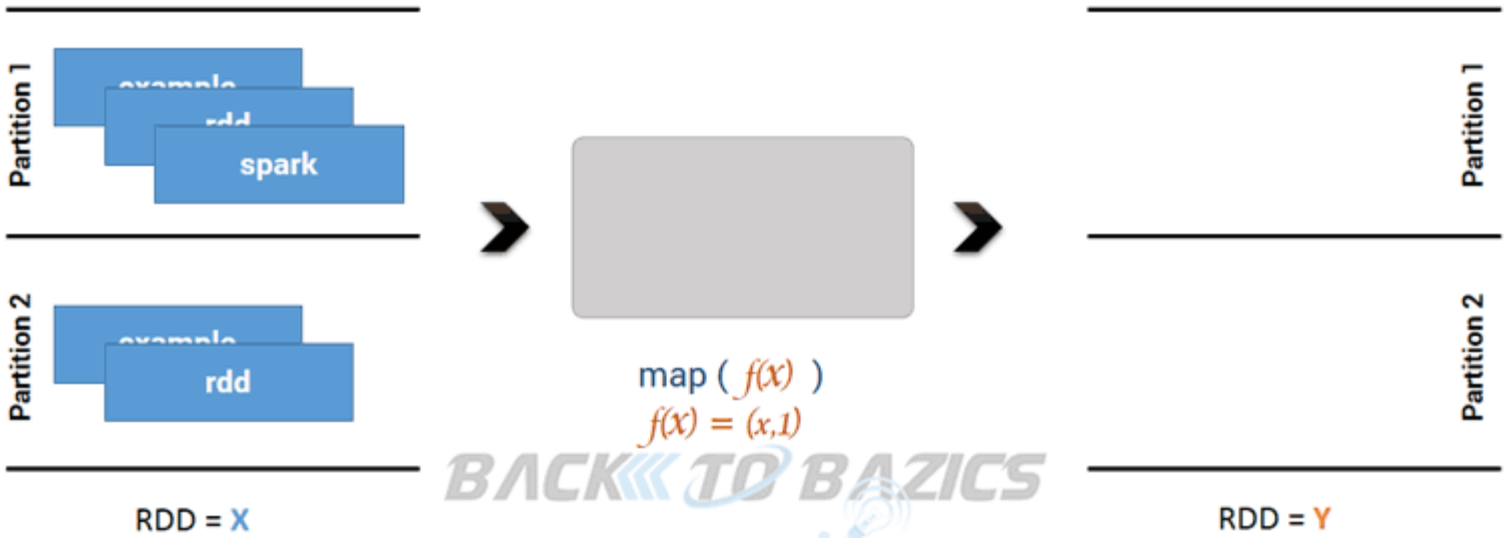
zipWithIndex

Zips this list with its indices.

Returns: A new list containing pairs consisting of all elements of this list paired with their index. Indices start at 0.

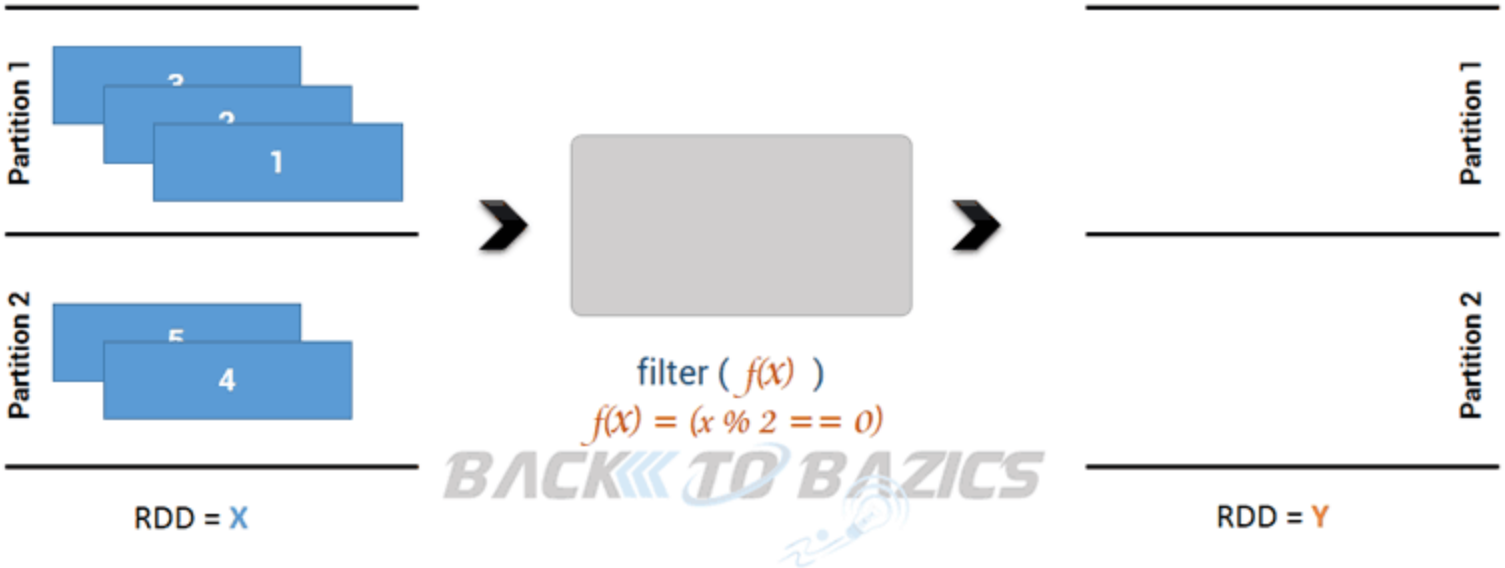
Map

Spark RDD map function returns a new RDD by applying a function to all elements of source RDD



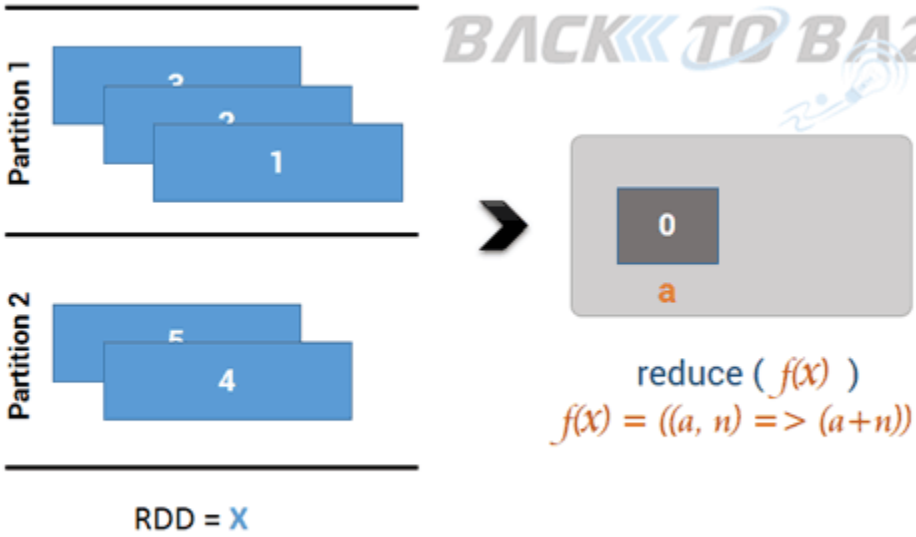
Filter

Spark RDD filter function returns a new RDD containing only the elements that satisfy a predicate.



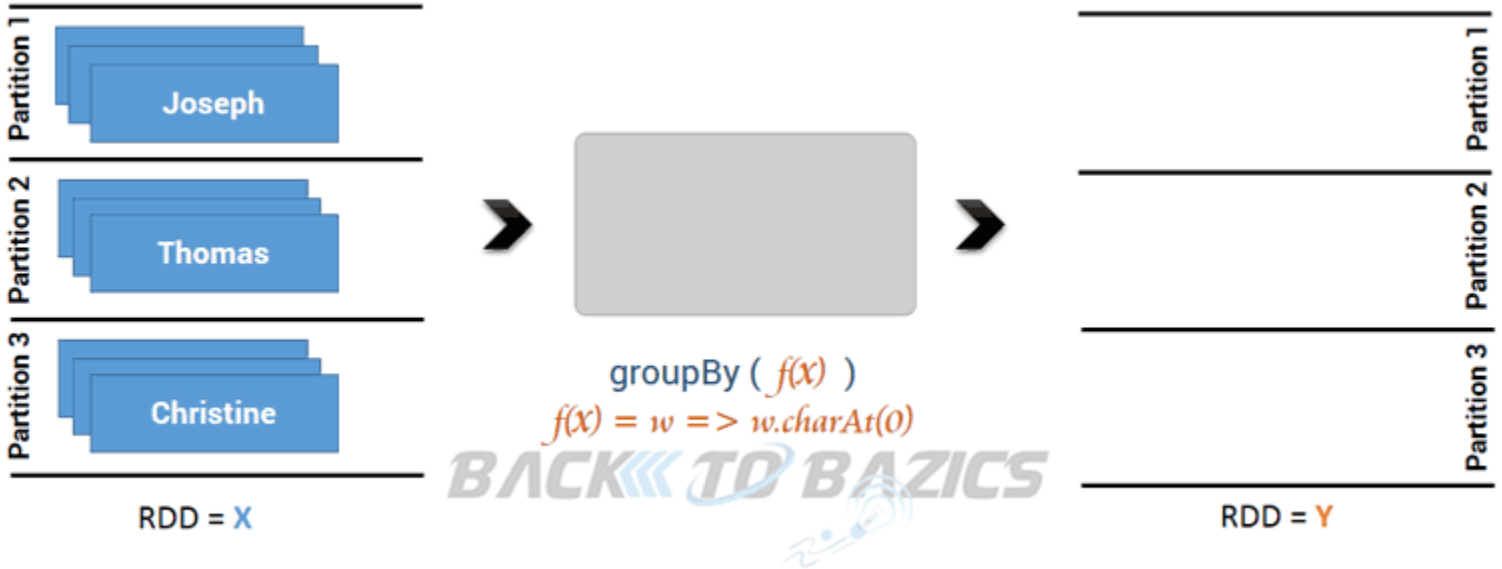
Reduce

Spark RDD reduce function reduces the elements of this RDD using the specified commutative and associative binary operator.



GroupBy

Spark RDD groupBy function returns an RDD of grouped items.



Scala functions (closures)

```
(x: Int) => x + 2 // full version

x => x + 2 // type inferred

_ + 2 // placeholder syntax (each argument must be used
exactly once)

x => { // body is a block of code
    val numberToAdd = 2
    x + numberToAdd
}

// Regular functions
def addTwo(x: Int): Int = x + 2
```

Quick Tour of Scala Part 2

(electric boogaloo)

Processing collections with functional programming

```
val lst = List(1, 2, 3)
list.foreach(x => println(x)) // prints 1, 2, 3
list.foreach(println)         // same

list.map(x => x + 2)    // returns a new List(3, 4, 5)
list.map(_ + 2)         // same

list.filter(x => x % 2 == 1)// returns a new List(1, 3)
list.filter(_ % 2 == 1)     // same

list.reduce((x, y) => x + y) // => 6
list.reduce(_ + _)           // same
```

All of these leave the list unchanged as it is immutable.

Functional methods on collections

There are a lot of methods on Scala collections, just **google Scala Seq** or http://www.scala-lang.org/api/2.10.4/index.html#scala.collection.Seq

Method on Seq[T]	Explanation
map(f: T => U): Seq[U]	Each element is result of f
flatMap(f: T => Seq[U]): Seq[U]	One to many map
filter(f: T => Boolean): Seq[T]	Keep elements passing f
exists(f: T => Boolean): Boolean	True if one element passes f
forall(f: T => Boolean): Boolean	True if all elements pass
reduce(f: (T, T) => T): T	Merge elements using f
groupBy(f: T => K): Map[K, List[T]]	Group elements by f
sortBy(f: T => K): Seq[T]	Sort elements
…..	

Lets Make our First Crash-Test

Our Data:

val data = 1 to 10000

create an RDD based on that data…

val distData = sc.parallelize(data)

then use a filter to select values less than 10…

distData.filter(_ < 10).collect()

Spark Deconstructed: *Log Mining Example*

```
// load error messages from a log into memory
// then interactively search for various patterns
// https://gist.github.com/ceteri/8ae5b9509a08c08a1132

// base RDD
val lines = sc.textFile("hdfs://...")

// transformed RDDs
val errors = lines.filter(_.startsWith("ERROR"))
val messages = errors.map(_.split("\t")).map(r => r(1))
messages.cache()

// action 1
messages.filter(_.contains("mysql")).count()

// action 2
messages.filter(_.contains("php")).count()
```

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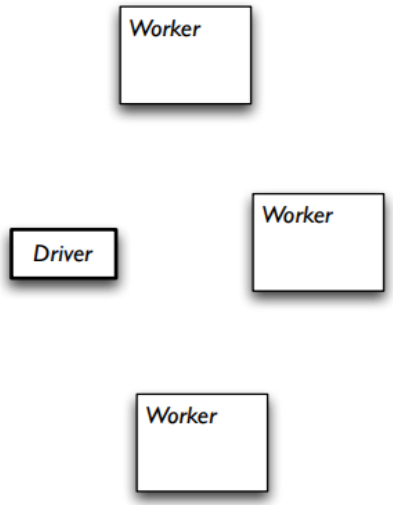
We start with Spark running on a cluster…
submitting code to be evaluated on it:



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discussing the other part

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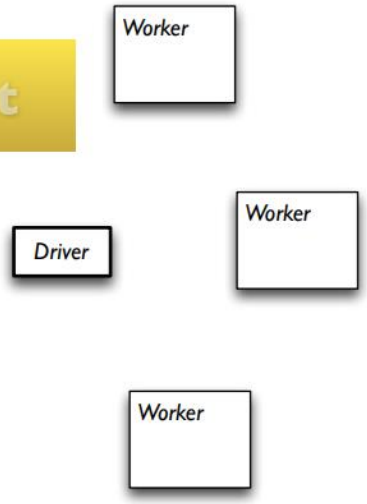

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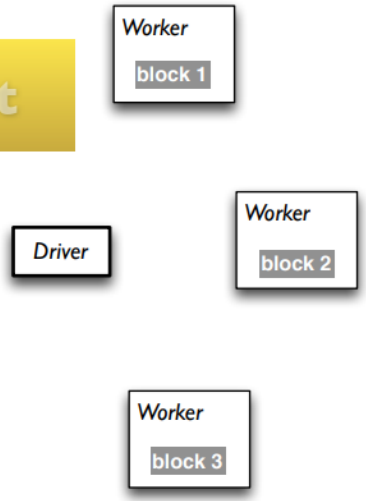

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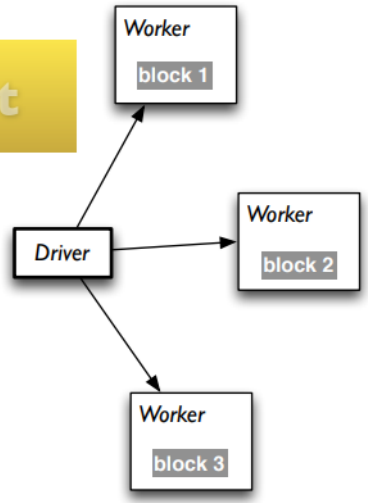

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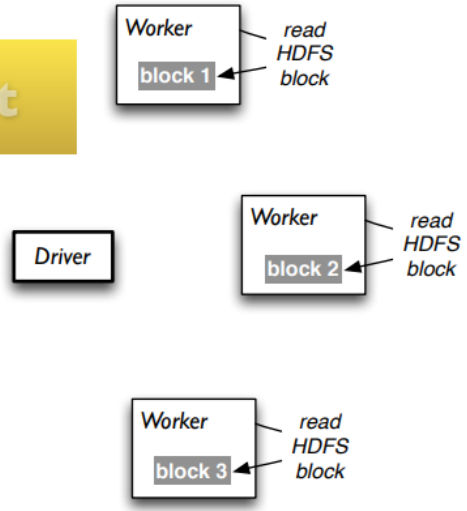

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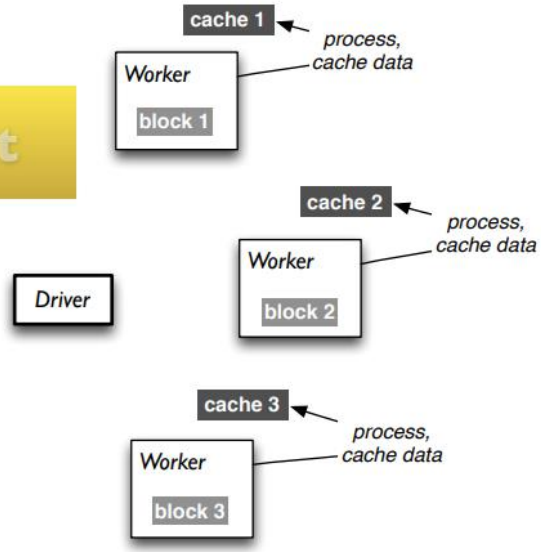

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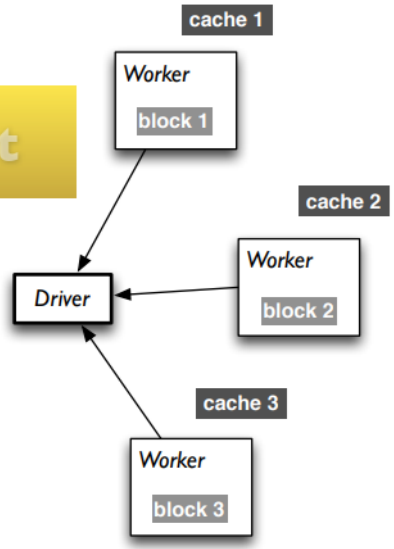

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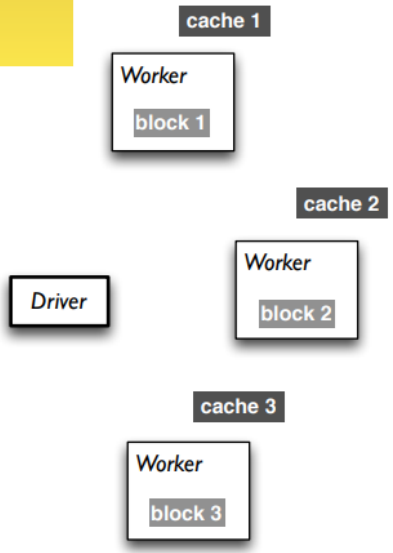

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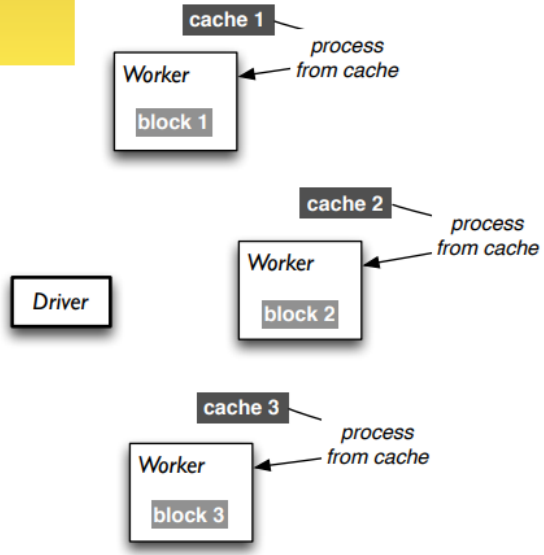

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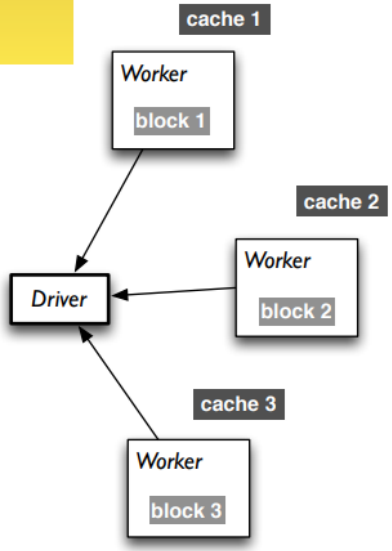

Spark Deconstructed:

Looking at the RDD transformations and actions from another perspective…

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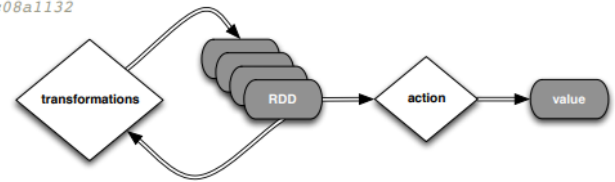

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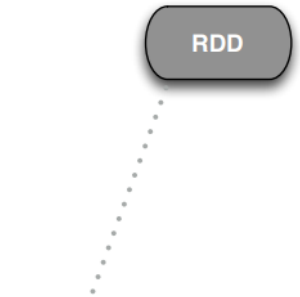


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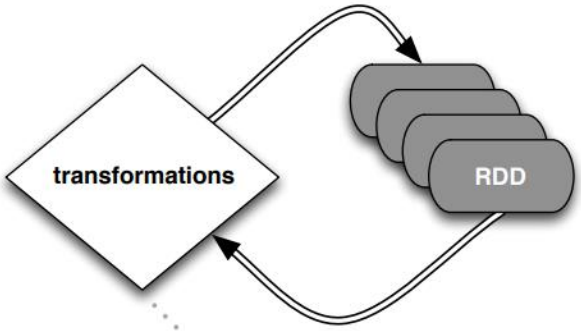


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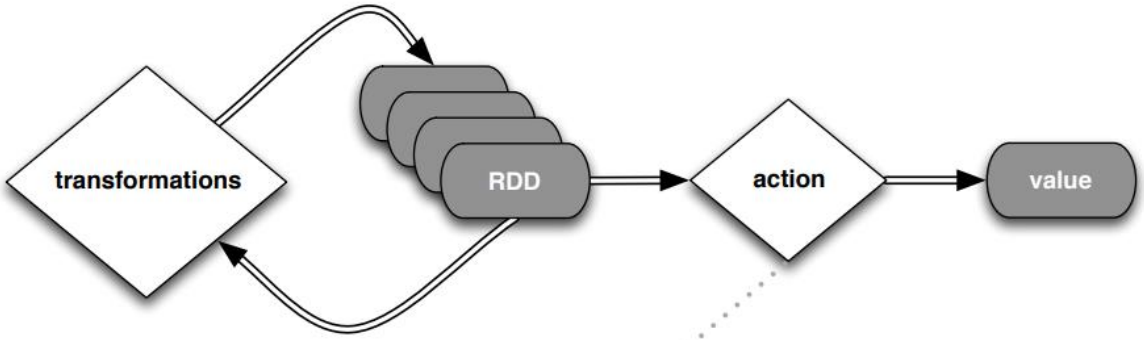


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Special Thanks

- CS543 Presentations
- Coursera Introduction to Apache Spark,University of California,Databricks
- https://backtobazics.com/big-data/spark