

A gentle introduction to



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Apache Spark



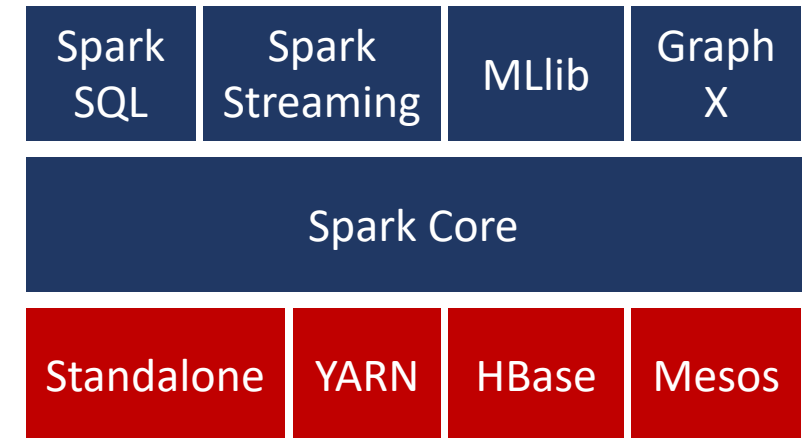
- Standard de facto per l'elaborazione di Big Data
- Lavora in memory
- 10 volte più veloce di MapReduce
- Semplice da utilizzare



Spark: Stack



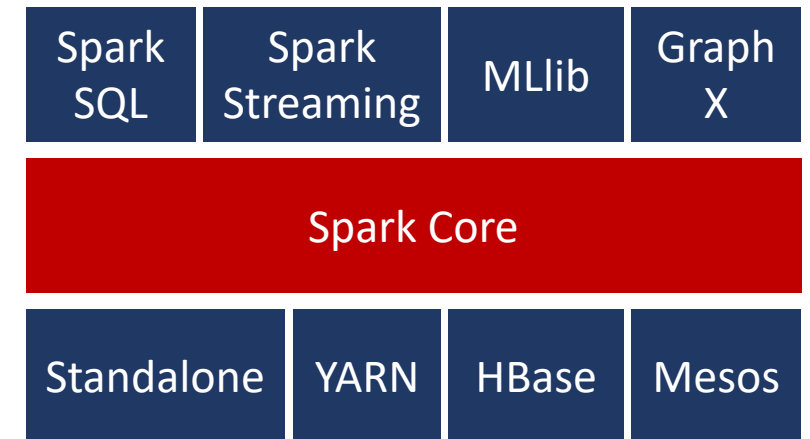
- **Cluster manager:** abilita l'accesso a risorse di calcolo distribuite
 - Standalone
 - YARN
 - Hbase
 - [...]



Spark: Stack



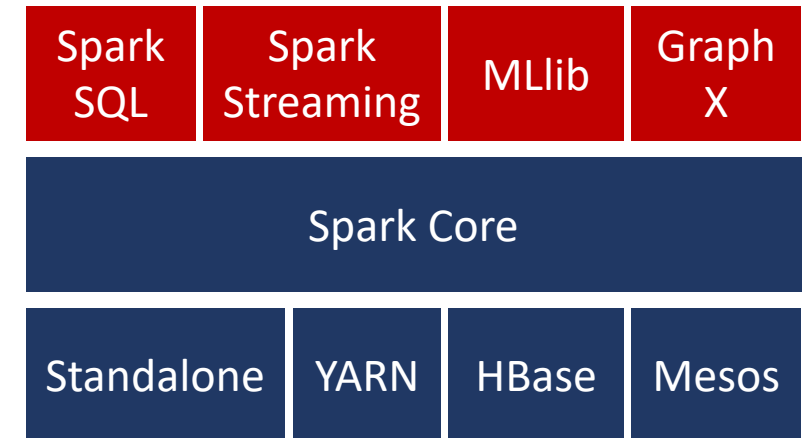
- **Spark core:** interfaccia di programmazione per l'elaborazione dei dati
- Fornisce API per Python, Scala, R, [...]
 - *Transformation*: manipolazione lazy su RDD
 - *Action*: eseguono le *Transformation* e restituiscono il risultato dell'elaborazione



Spark: Stack



- **Librerie:** interfaccia di programmazione per l'elaborazione dei dati
 - Standard: Spark SQL, Spark Streaming, MLlib, GraphX
 - Terze parti: Koalas, Mlflow, GeoSpark, [...]



Spark: RDD



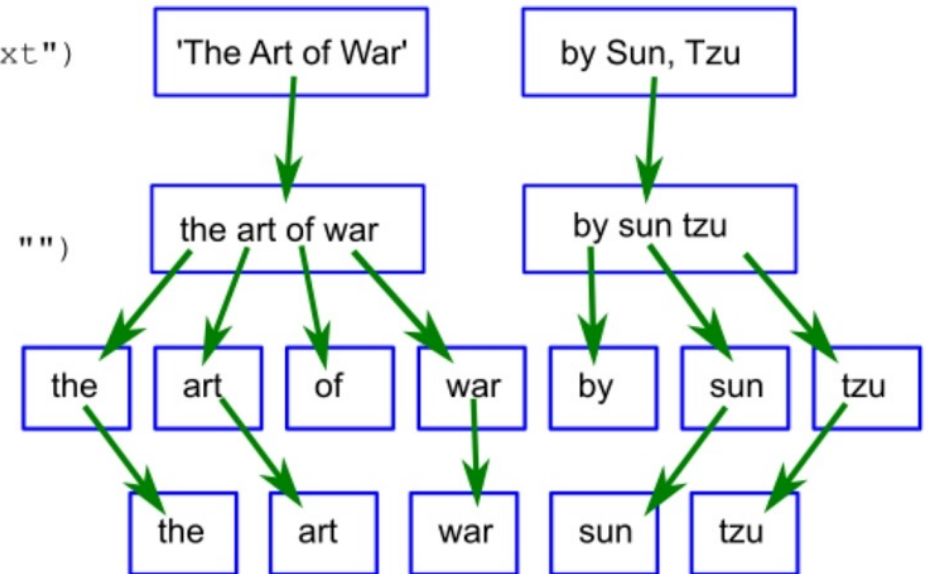
- Collezioni di dati partizionate e Read-only
- Si rappresenta con un DAG
- Resilienti: in caso di problemi, si riprende l'esecuzione esattamente dal punto dove è stato interrotto

```
sc.textFile("artofwar.txt")
```

```
.map(  
  _.toLowerCase  
  .replaceAll("[^\\w ]", "")  
)
```

```
.flatMap(_.split(" "))
```

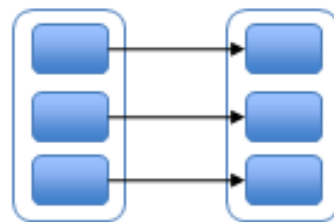
```
.filter(_.size > 2)
```



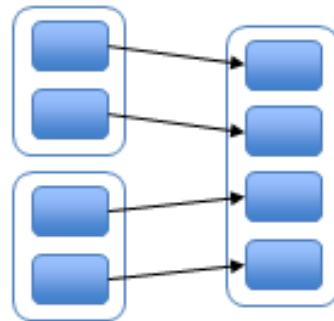
Spark: Transformation



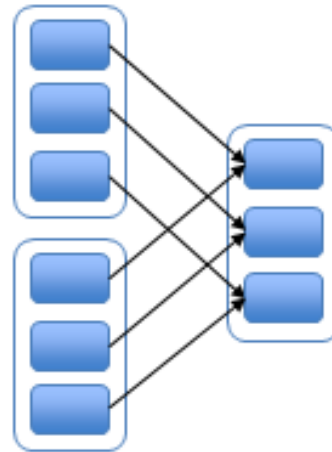
“Narrow” deps:



map, filter

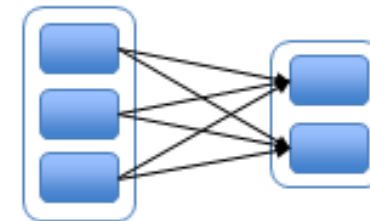


union

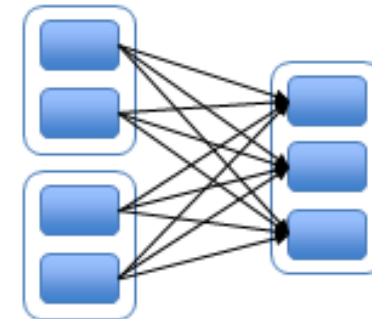


join with
inputs co-
partitioned

“Wide” (shuffle) deps:



groupByKey



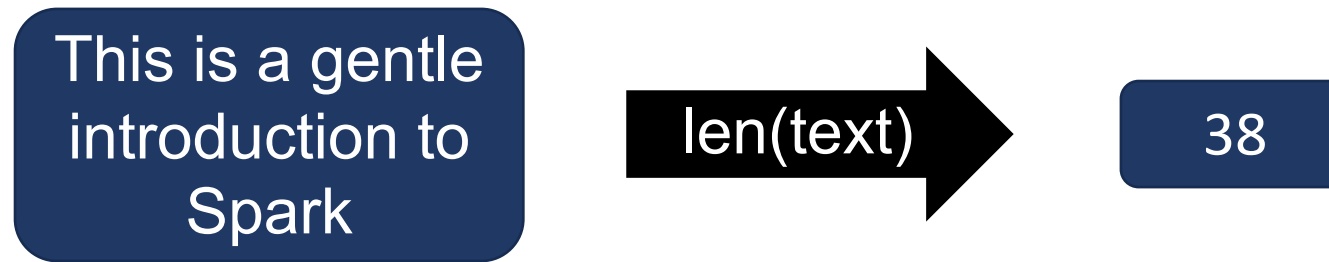
join with inputs not
co-partitioned

Spark: Transformation



■ Map

Return a new distributed dataset formed by passing each element of the source through a function *func*



[1] <https://spark.apache.org/docs/latest/rdd-programming-guide.html#transformations>

Spark: Transformation



▪ FlatMap

Similar to map, but each input item can be mapped to 0 or more output items (so *func* should return a Seq rather than a single item)

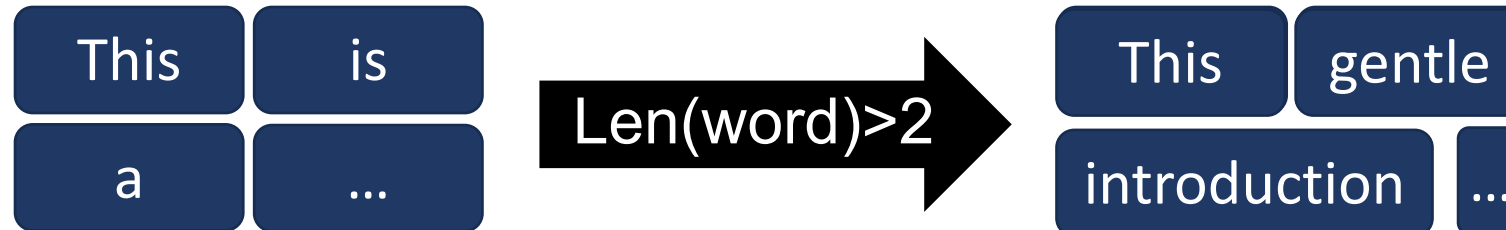


Spark: Transformation



▪ Filter

Return a new dataset formed by selecting those elements of the source on which *func* returns true

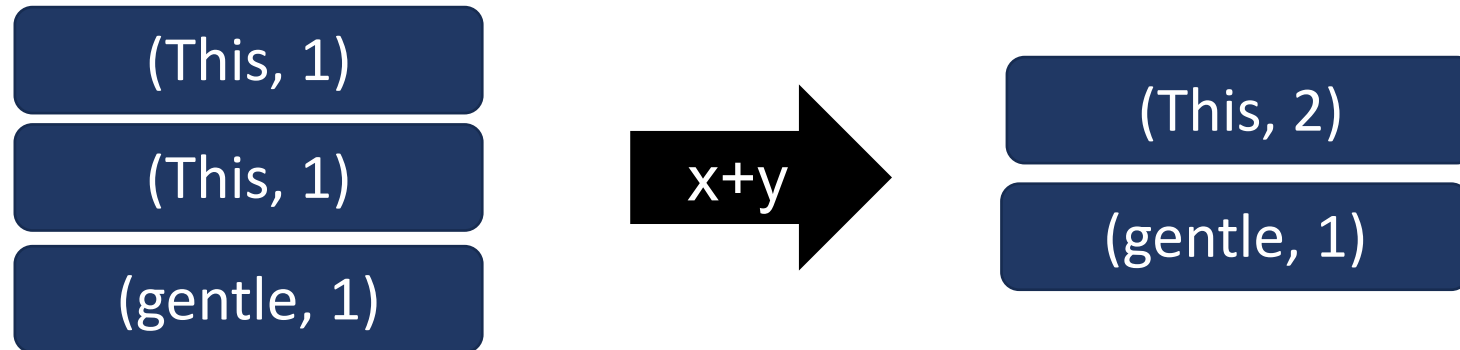


Spark: Transformation



▪ ReduceByKey

When called on a dataset of (K, V) pairs, returns a dataset of (K, V) pairs where the values for each key are aggregated using the given reduce function *func*, which must be of type $(V, V) \Rightarrow V$



[1] <https://spark.apache.org/docs/latest/rdd-programming-guide.html#transformations>

Spark: Actions



- **Reduce**

- Aggregate the elements of the dataset using a function *func* (which takes two arguments and returns one)

- **Collect**

- Return all the elements of the dataset as an array at the driver program

- **Count**

- Return the number of elements in the dataset

Spark: Actions



- **Take**

- Return an array with the first n elements of the dataset.
- **First** return the first element of the dataset

- **countByKey**

- Only available on RDDs of type (K, V) . Returns a hashmap of (K, Int) pairs with the count of each key

- **Foreach**

- Run a function *func* on each element of the dataset

Spark: Note



- Dopo la lezione, sarà disponibile un repository GitHub contenente sia gli esercizi che le slide
 - [3] <https://github.com/AlessandroMele/EsercitazioniBDA&ML>

Let's start coding!

