SparkR
The Past, Present and Future

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Big Data & R

DataFrames
Visualization
Libraries

R + Data

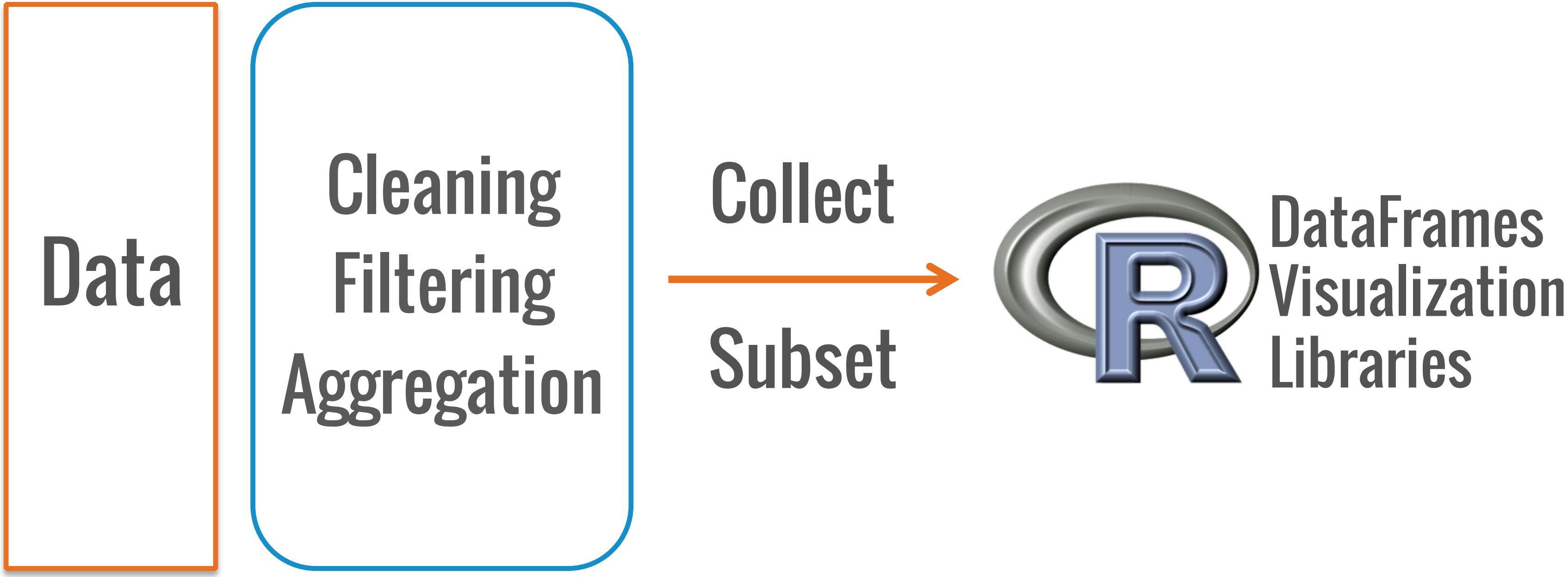
Big Data & R

Big Data
Small Learning

Partition
Aggregate

Large Scale
Machine Learning

1. Big Data, Small Learning



Data

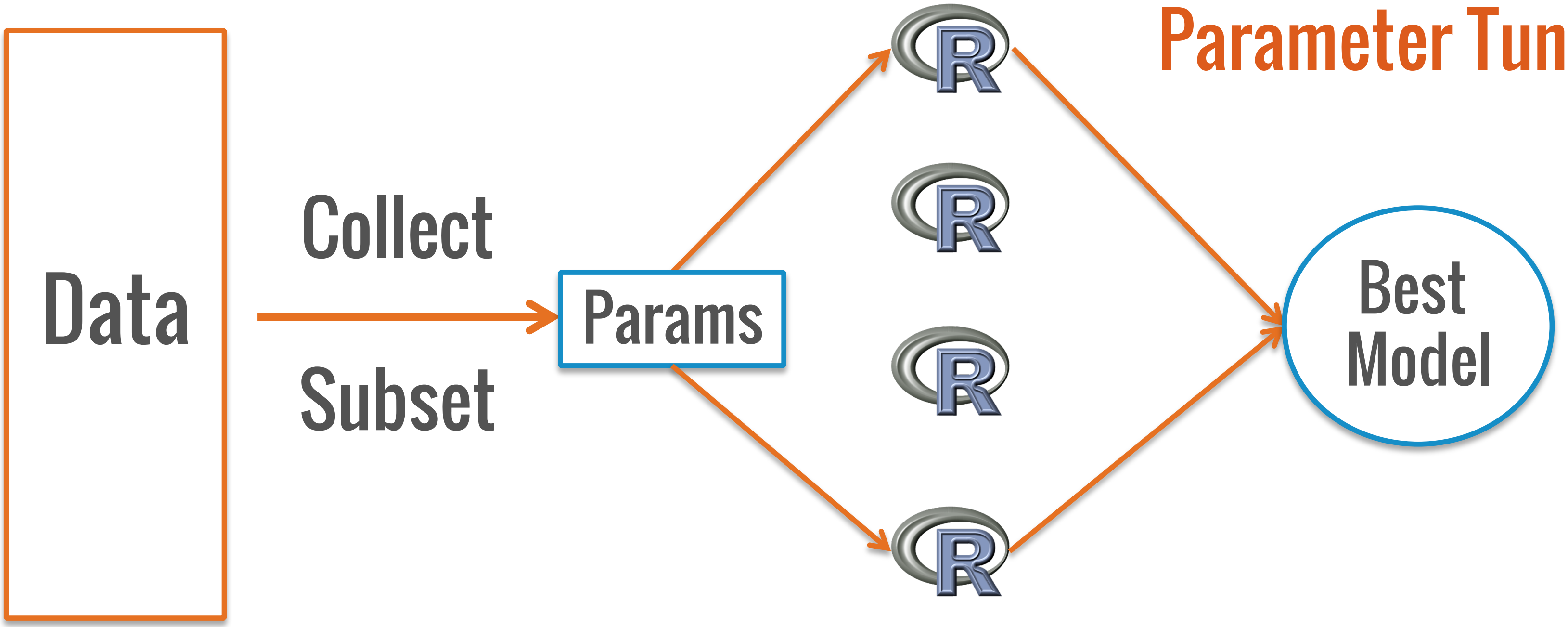
Cleaning
Filtering
Aggregation

Collect

Subset

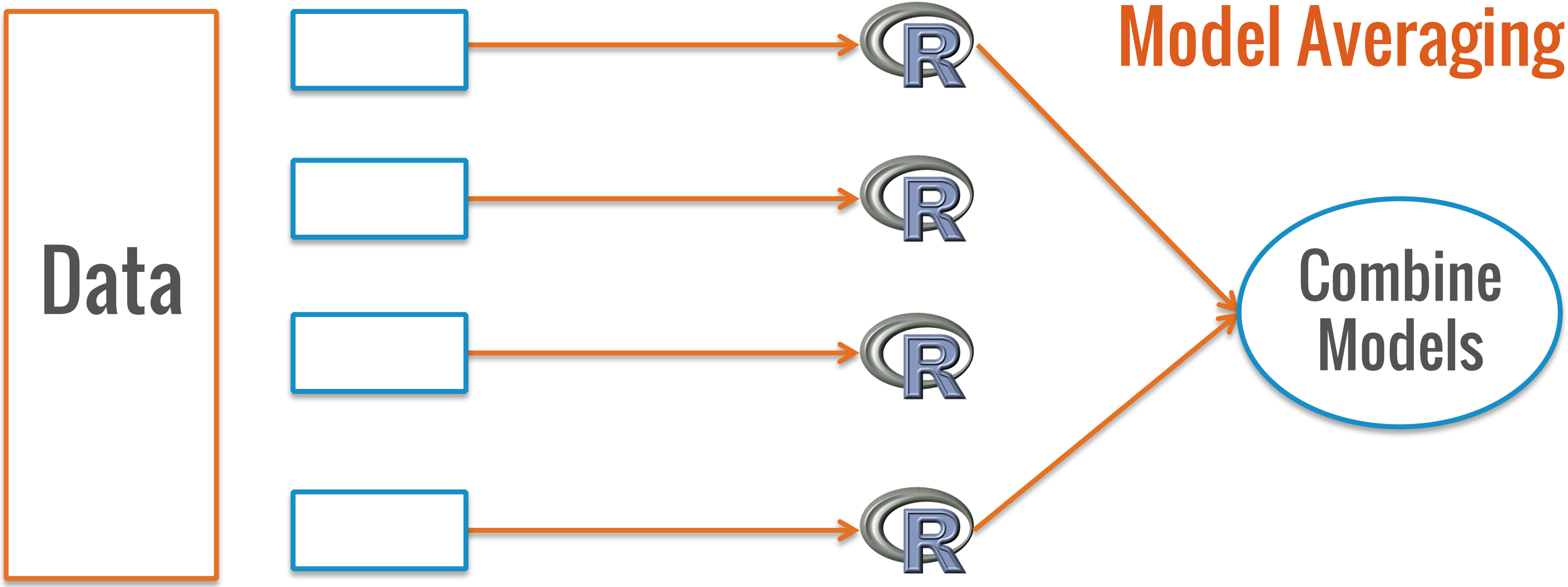
DataFrames
Visualization
Libraries

2(a). Partition Aggregate



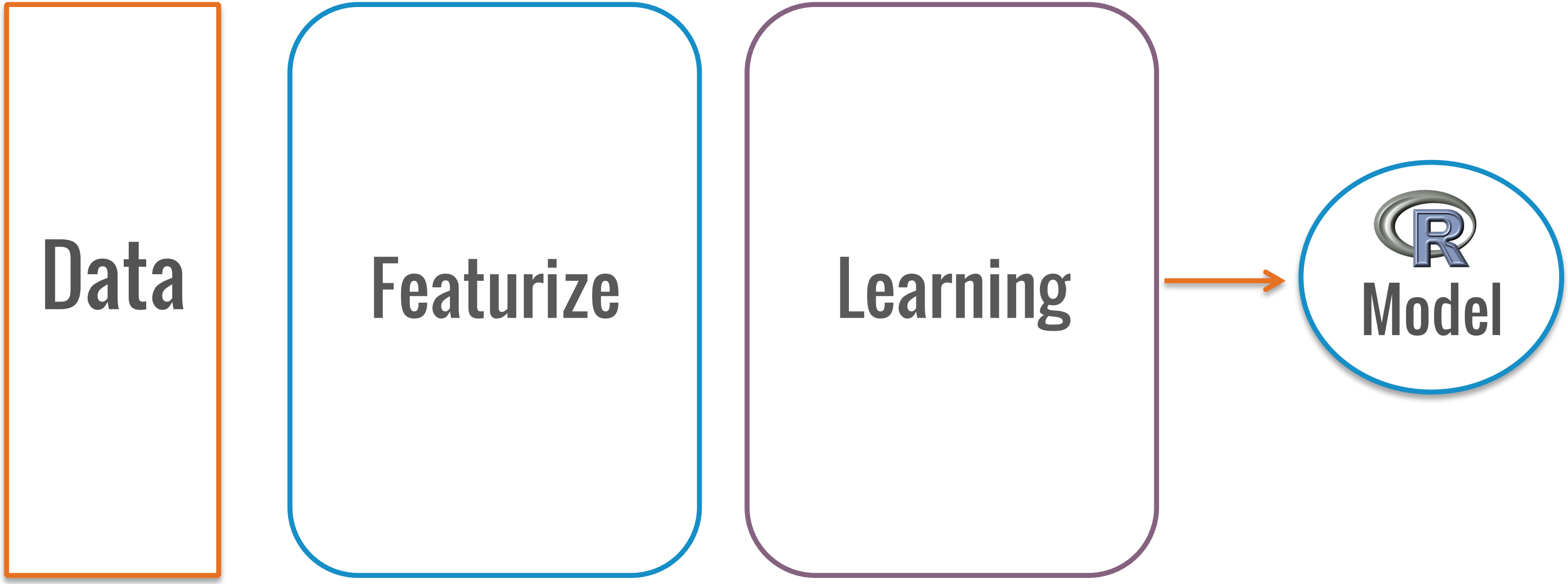
Parameter Tuning

2(b). Partition Aggregate



Model Averaging

3. Large Scale Machine Learning



Big Data & R

Big Data
Small Learning

Partition
Aggregate

Large Scale
Machine Learning

SparkR:
Unified approach

Outline

Project History

Current Release

SparkR Future

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Speed

Statistics

Scalable Spark + R DataFrames

Flexible

Visualization

Spark

RDD

Parallel Collection

Transformations

map
filter
groupBy
...

Actions

count
collect
saveAsTextFile
...

R + RDD = RRDD

lapply

lapplyPartition

groupByKey

collect

cache

...

broadcast

includePackage

textFile

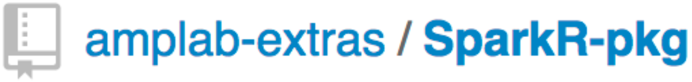
Example: Word Count

```
library(SparkR)
lines <- textFile(sc, “hdfs://my_text_file”)
words <- flatMap(lines,
                 function(line) {
                   strsplit(line, " ")[[1]]
                 })
wordCount <- lapply(words,
             function(word) {
               list(word, 1L)
             })
counts <- reduceByKey(wordCount, "+", 2L)
output <- collect(counts)
```

Initial Prototype

Standalone R package

Install from github

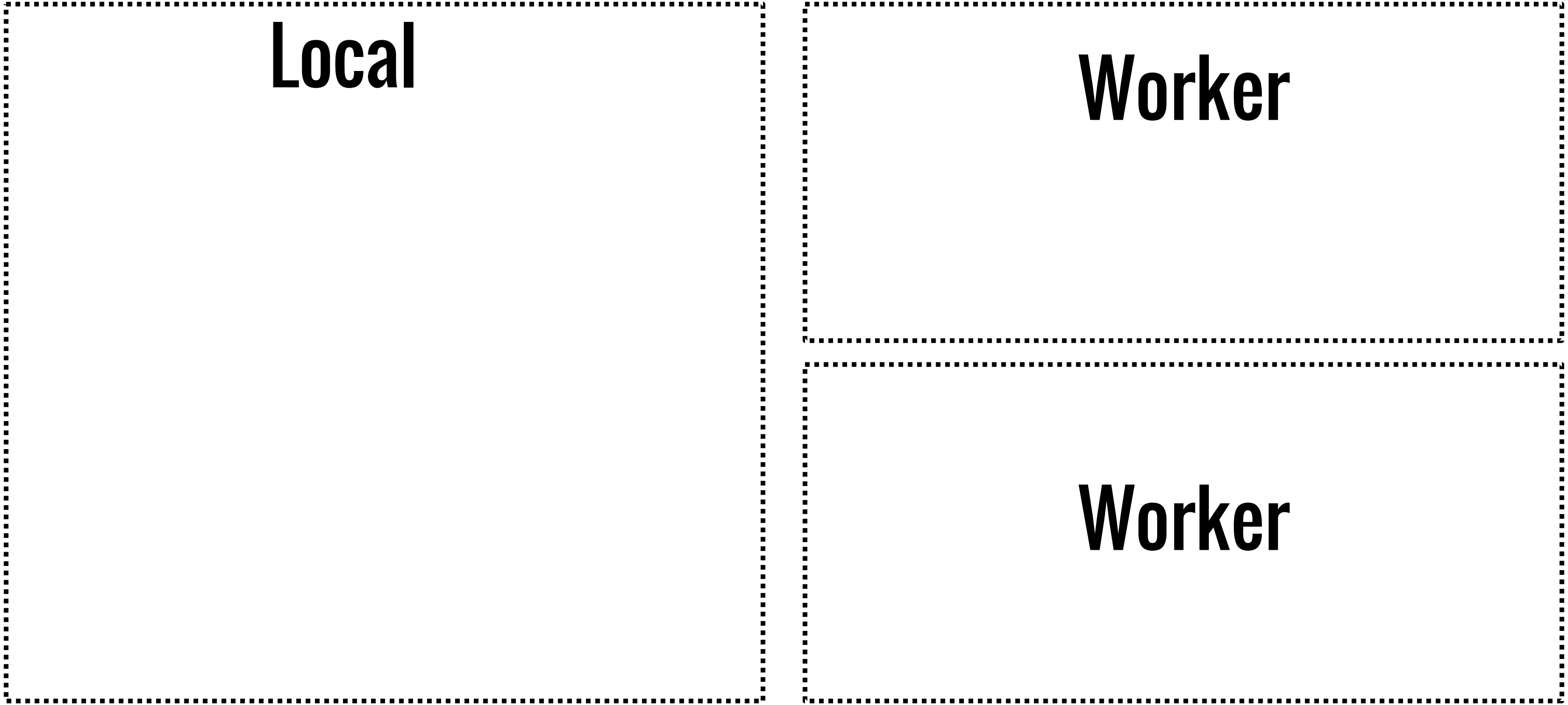


amplab-extras / SparkR-pkg

Open Source Development

1. Architecture
2. Usability

Architecture

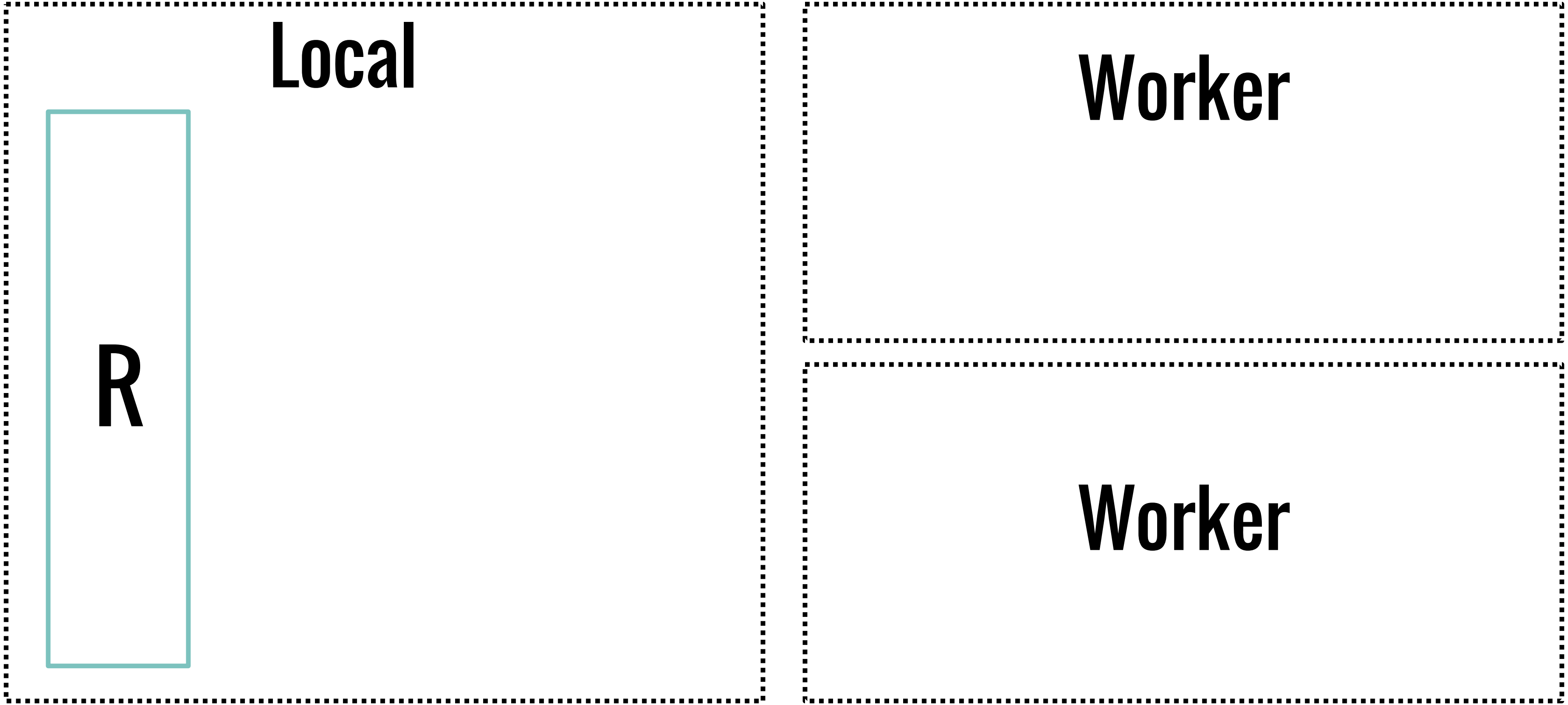


Local

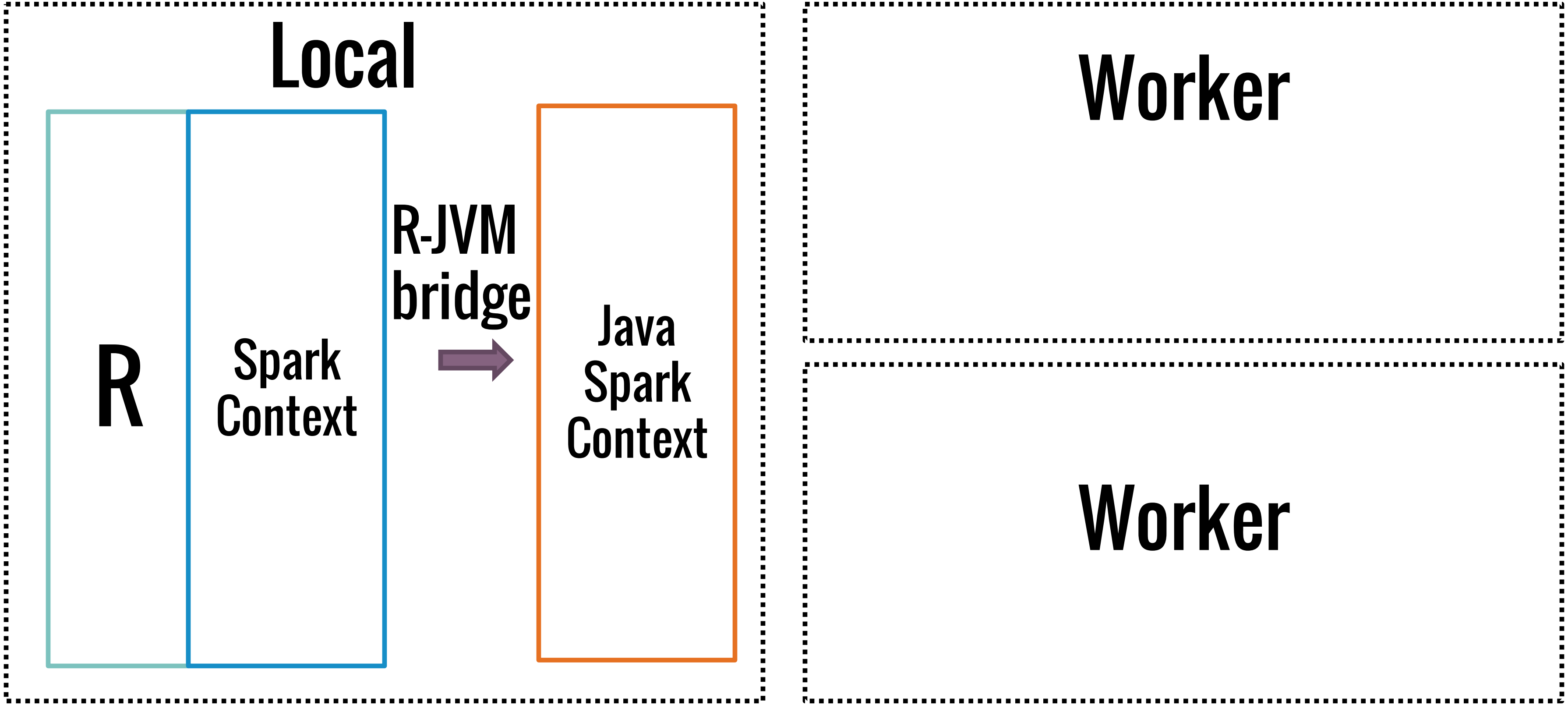
Worker

Worker

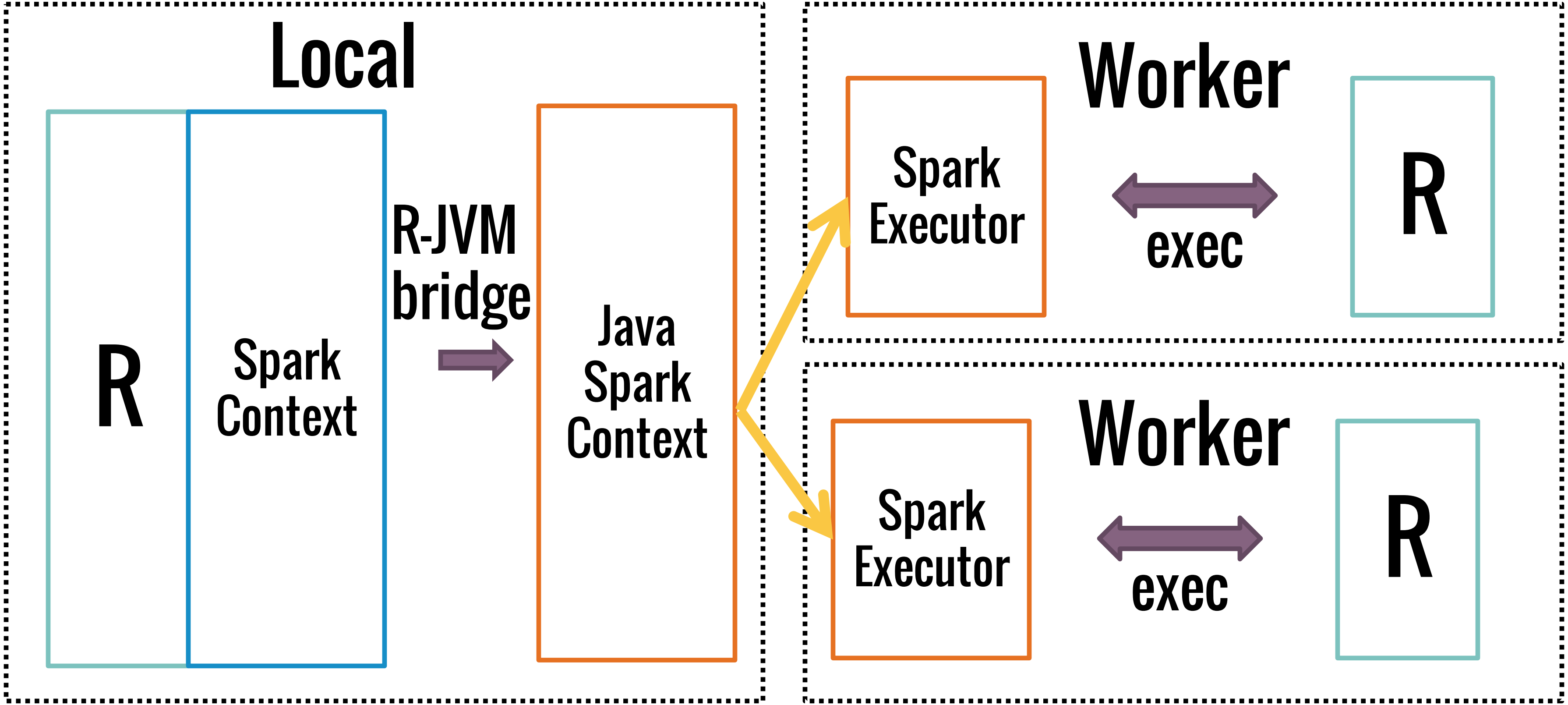
Architecture



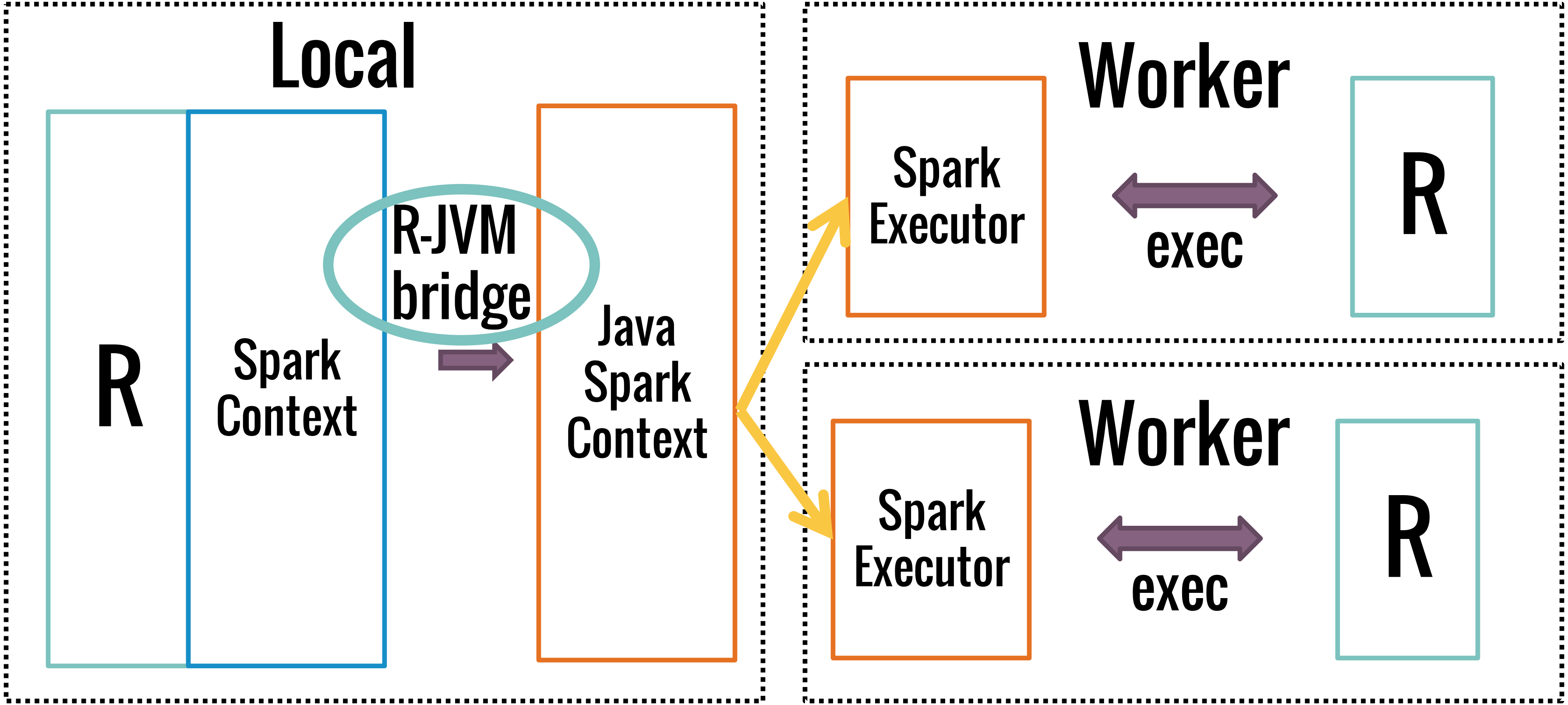
Architecture



Architecture



Architecture



R-JVM Bridge

Layer to call JVM methods directly from R

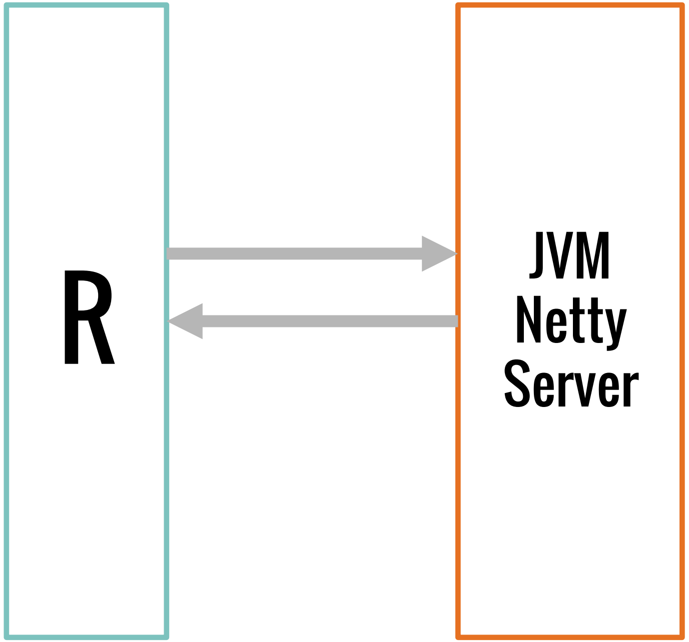
Automatic argument serialization

```
result <-
  callJStatic(
    “sparkr.RRDD”,
    “someMethod”,
    arg1,
    arg2)
```

R-JVM Bridge

Use *sockets* for communication

Supported across platforms, languages



Usability

Need for Data Inputs

- Read in CSV, JSON, JDBC etc.

High-level API for data manipulation

SparkR DataFrames

DataSources API

Support for schema

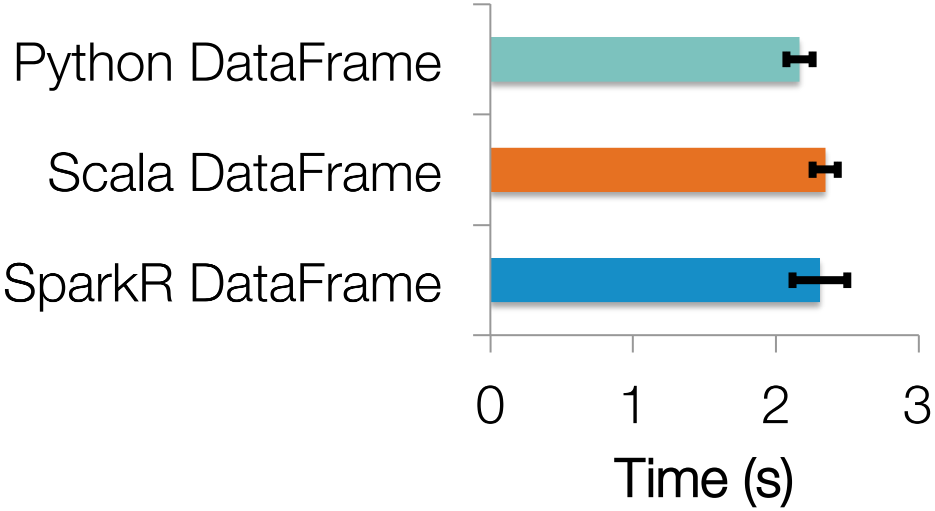
dplyr-like syntax

```
people <- read.df(
    “people.json”,
    “json”)

avgAge <- select(
    df,
    avg(df$age))

head(avgAge)
```

SparkR DataFrames

Scala Optimizations

Released in Spark 1.4 !



Demo: github.com/cafreeman/SparkR_DataFrame_Demo

SparkR Future

Big Data & R

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Big Data, Small Learning

SparkR DataFrames: Read input, aggregation
Collect results, apply machine learning

Upcoming features:

- Support for R transformations
- More column functions (e.g. math, strings)

Partition Aggregate

Upcoming feature:

Simple, parallel API for SparkR

Ex: Parameter tuning, Model Averaging

Integrated with DataFrames

Use existing R packages

Large Scale Machine Learning

Integration with MLLib

Support for GLM, KMeans etc.

```
model <- glm(
   a ~ b + c,
   data = df)
```

Large Scale Machine Learning

Key Features

- DataFrame inputs
- R-like formulas
- Model statistics

```
model <- glm(
   a ~ b + c,
   data = df)

summary(model)
```

Extensibility

Existing data sources

R package support on spark-packages.org

Example packages

```
./bin/sparkR
  --packages spark-csv
```

Developer Community

>20 contributors including
AMPLab, Databricks, Alteryx, Intel

R and Scala contributions welcome !

SparkR

Big data processing from R

DataFrames in Spark 1.4

Future: Large Scale ML & more