How to submit/execute a Spark application

Spark-submit

- Spark programs are executed (submitted) by using the spark-submit command
  - It is a command line program
  - It is characterized by a set of parameters
    - E.g., the name of the jar file containing all the classes of the Spark application we want to execute
    - The name of the Driver class
    - The parameters of the Spark application
    - etc.

Spark-submit

- spark-submit has also two parameters that are used to specify where the application is executed
  - **--master** option
    - Specify which environment/scheduler is used to execute the application

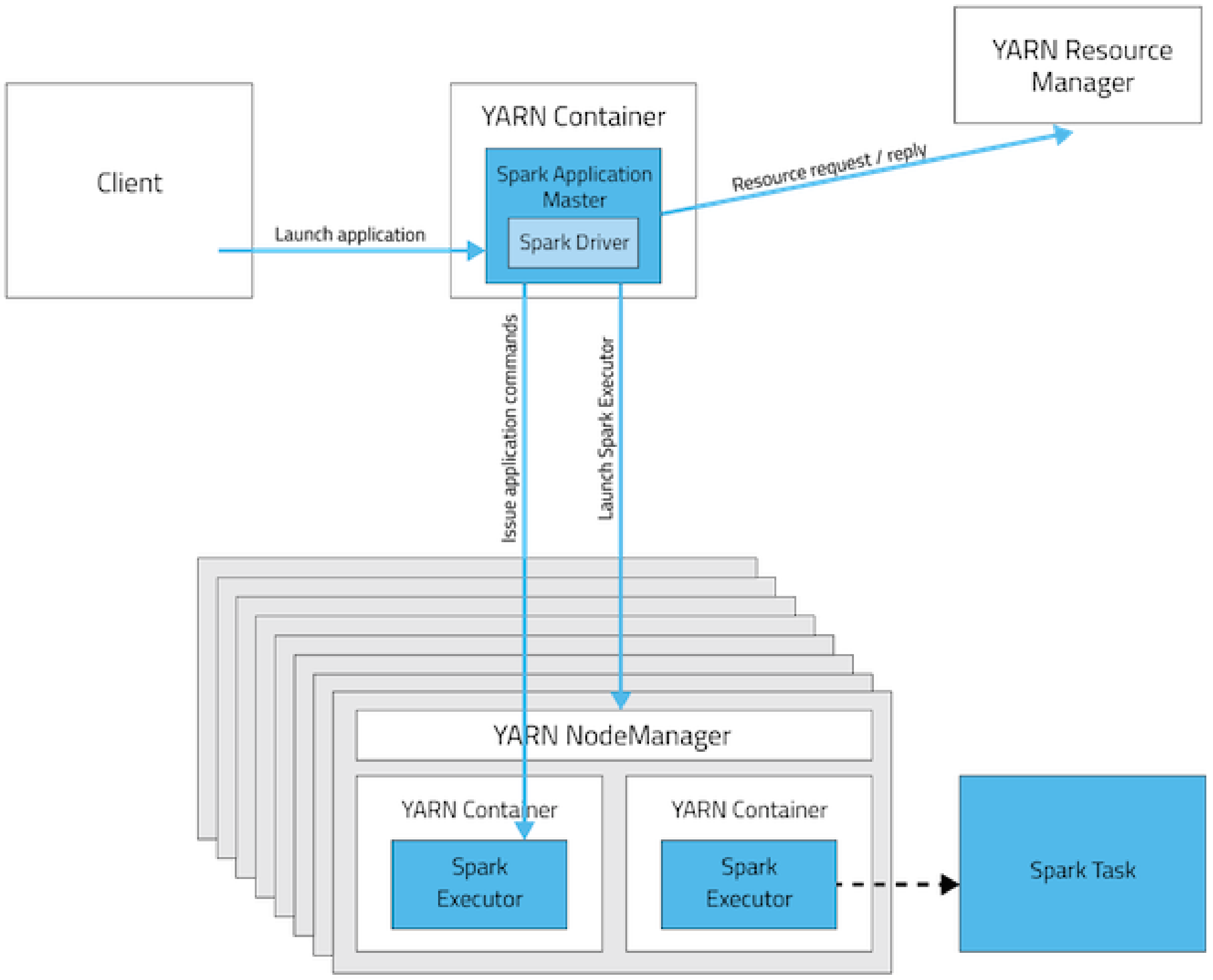
spark://host:port	The spark scheduler is used
mesos://host:port	The memos scheduler is used
yarn	The YARN scheduler (i.e., the one of Hadoop)
local	The application is executed exclusively on the local PC

Spark-submit

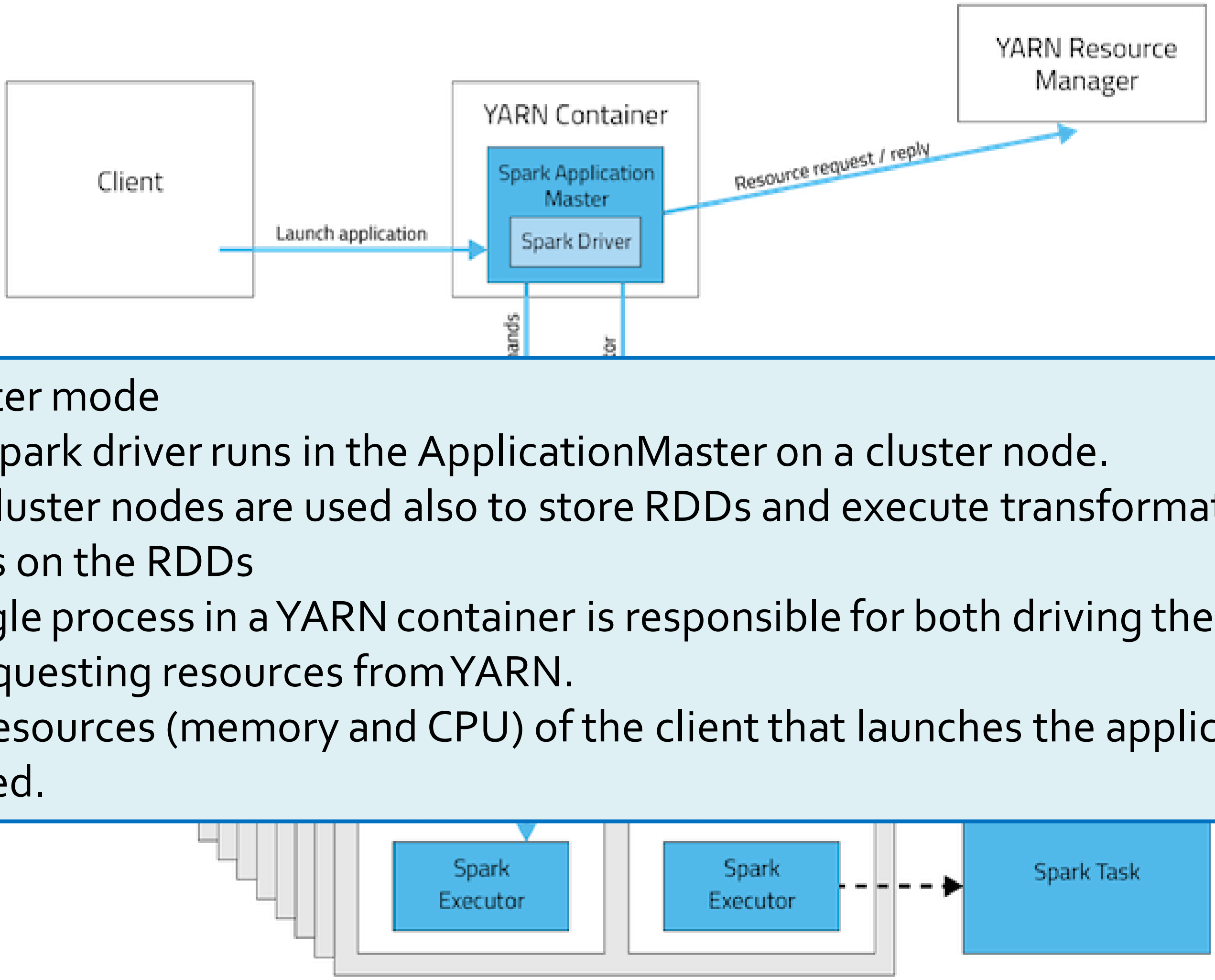
- **--deploy-mode** option
  - Specify where the Driver is launched/executed

client	The driver is launched locally (in the "local" PC executing spark-submit)
cluster	The driver is launched on one node of the cluster

Cluster Deployment Mode



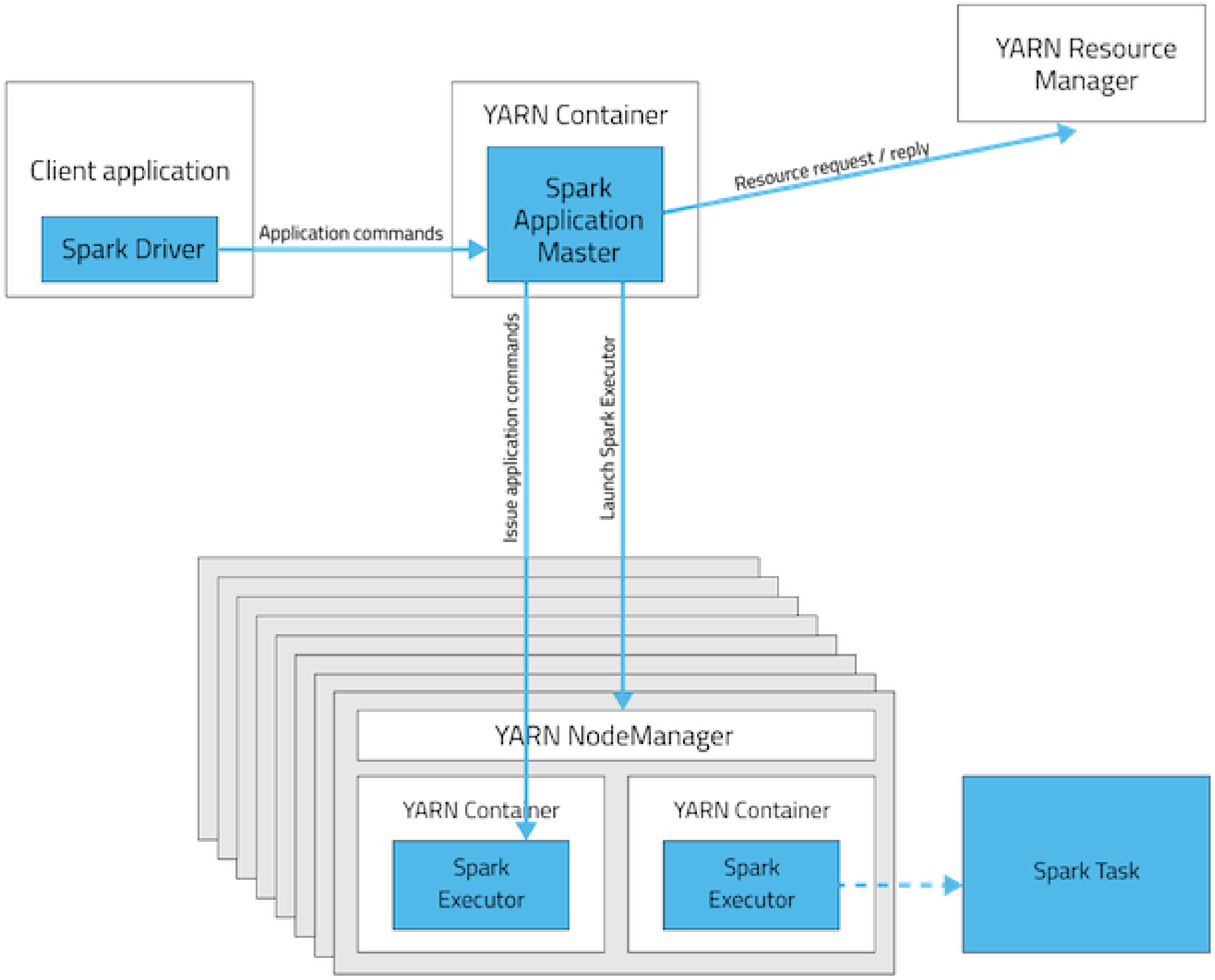
Cluster Deployment Mode



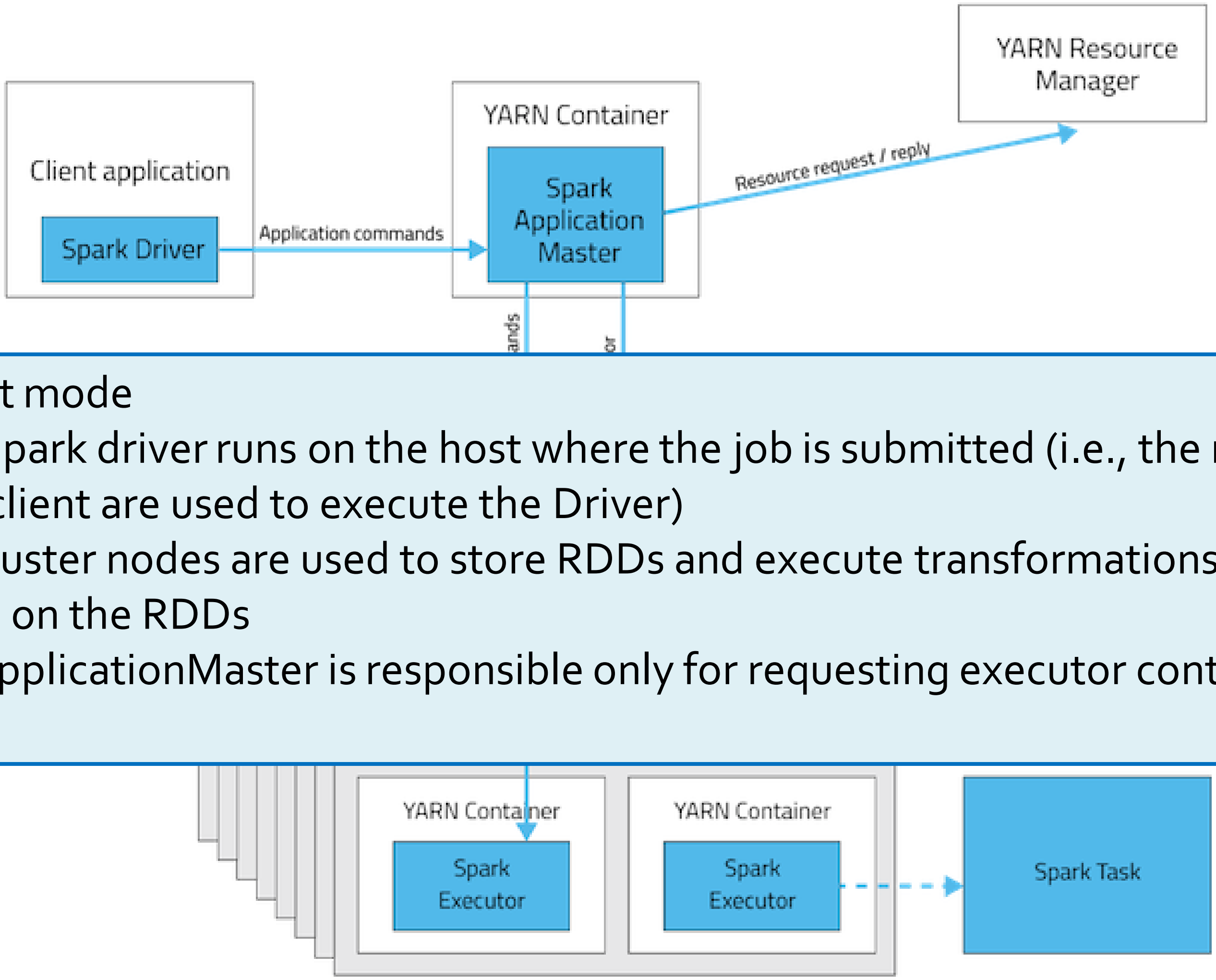
In cluster mode

- The Spark driver runs in the ApplicationMaster on a cluster node.
- The cluster nodes are used also to store RDDs and execute transformations and actions on the RDDs
- A single process in a YARN container is responsible for both driving the application and requesting resources from YARN.
- The resources (memory and CPU) of the client that launches the application are not used.

Client Deployment Mode



Client Deployment Mode



In client mode
- The Spark driver runs on the host where the job is submitted (i.e., the resources of the client are used to execute the Driver)
- The cluster nodes are used to store RDDs and execute transformations and actions on the RDDs
- The ApplicationMaster is responsible only for requesting executor containers from YARN.

Spark-submit: setting executors

- Spark-submit allows specifying
  - The number of executors
    - --num-executors NUM
      - Default value: NUM=2 executors
  - The number of cores per executor
    - --executor-cores NUM
      - Default value: NUM=1 core
  - Main memory per executor
    - --executor-memory MEM
      - Default value: MEM=1GB
- The maximum values of these parameters are limited by the configuration of the cluster

Spark-submit: setting driver

- Spark-submit allows specifying
  - The number of cores for the driver
    - --driver-cores NUM
      - Default value: NUM=1 core
  - Main memory for the driver
    - --driver-memory MEM
      - Default value: MEM=1GB
- Also the maximum values of these parameters are limited by the configuration of the cluster when the deploy-mode is set to cluster

Spark-submit: Execution on the cluster

- The following command submits a Spark application on a Hadoop cluster

spark-submit --class *it.polito.spark.DriverMyApplication* --deploy-mode *cluster* --master *yarn MyApplication.jar arguments*

  - It executes/submits the application it.polito.spark.DriverMyApplication contained in MyApplication.jar
  - The application is executed on a Hadoop cluster based on the YARN scheduler
    - Also the Driver is executed in a node of cluster

Spark-submit: Local execution

- The following command submits a Spark application on a local PC

  spark-submit --class *it.polito.spark.DriverMyApplication* --deploy-mode *client* --master *local MyApplication.jar arguments*

  - It executes/submits the application it.polito.spark.DriverMyApplication contained in MyApplication.jar
  - The application is completely executed on the local PC
    - Both Driver and Executors
    - Hadoop is not needed in this case
    - You only need the Spark software