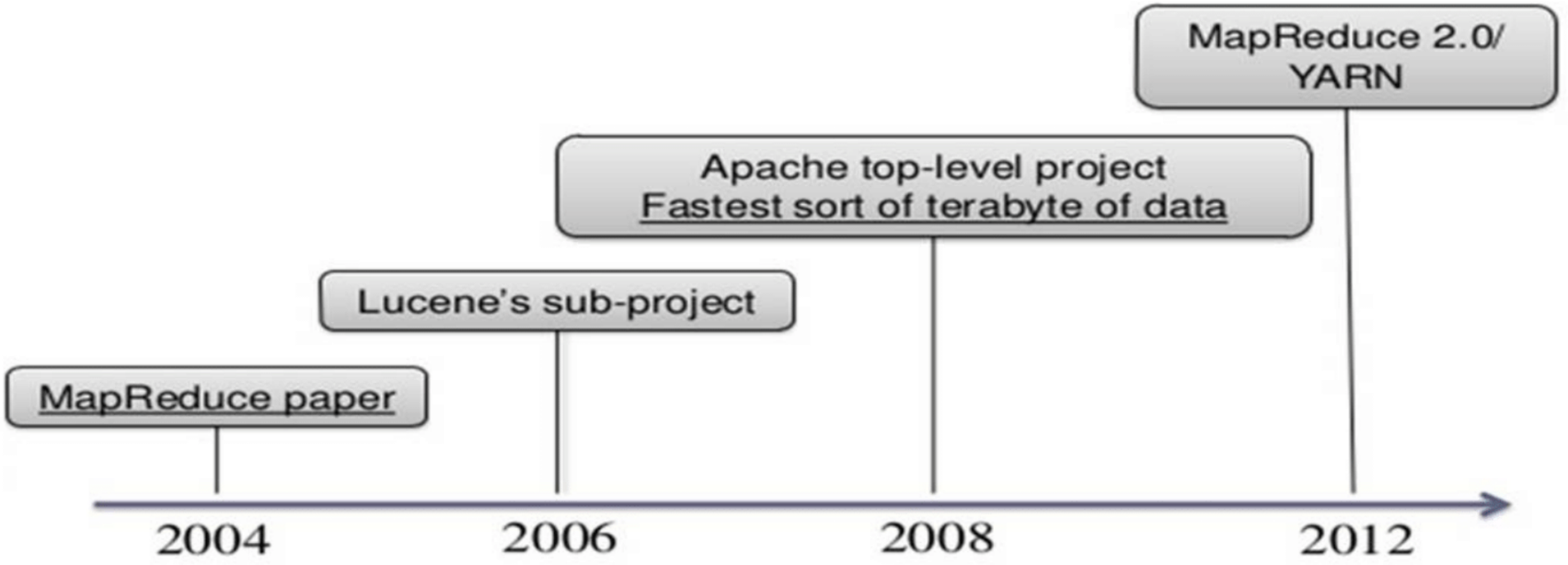
YARN

Yet Another Resource Negotiator

Agenda

- ✓ Evolution of YARN
- ✓ Architecture
- ✓ Ecosystem
- ✓ Introduction to YARN
- ✓ Daemons
- ✓ Application Execution
- ✓ Container
- ✓ MapReduce Application Execution

Evolution of yarn



The Data Operating System for Hadoop 2.0

Flexible

Enables other purpose-built data processing models beyond MapReduce (batch), such as interactive and streaming

Efficient

Increase processing **IN** Hadoop on the same hardware while providing predictable performance & quality of service

Shared

Provides a stable, reliable, secure foundation and shared operational services across multiple workloads

Hadoop Yarn

- Apache™ Hadoop® YARN is a sub-project of Hadoop at the Apache Software Foundation introduced in Hadoop 2.0 that separates the resource management and processing components.
- The YARN-based architecture of Hadoop 2.0 provides a more general processing platform that is not constrained to MapReduce.
- YARN takes the resource management capabilities that were in MapReduce and packages them so they can be used by new engines.

Hadoop Yarn

- The fundamental idea of YARN is to split up the two major responsibilities of the JobTracker i.e. resource management and job scheduling / monitoring, into separate daemons: a global ResourceManager and per-application ApplicationMaster (AM).
- The ResourceManager and per-node slave, the NodeManager (NM), form the new, and generic, **system** for managing applications in a distributed manner.

Key Improvements in YARN

- Framework supporting multiple applications
  - Separate generic resource brokering from application logic
  - Define protocols/libraries and provide a framework for custom application development
  - Share same Hadoop Cluster across applications
- Cluster Utilization
  - Generic resource container model replaces fixed Map/Reduce slots. Container allocations based on locality, memory
  - Sharing cluster among multiple application

Key Improvements in YARN

- Scalability
  - Removed complex app logic from RM, scale further
  - State machine, message passing based loosely coupled design
  - Compact scheduling protocol
- Application Agility and Innovation
  - Map Reduce becomes an application in user space unlocking safe innovation
  - Multiple versions of an app can co-exist leading to experimentation
  - Easier upgrade of framework and application

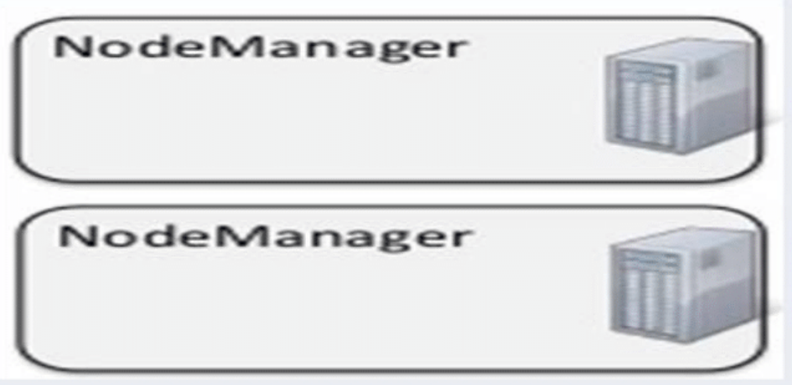
Yarn daemons

Resource Manger (RM)

- Run on the master node.
- Global Resource scheduler
- Arbitrate System resources between competing application

Node Manger

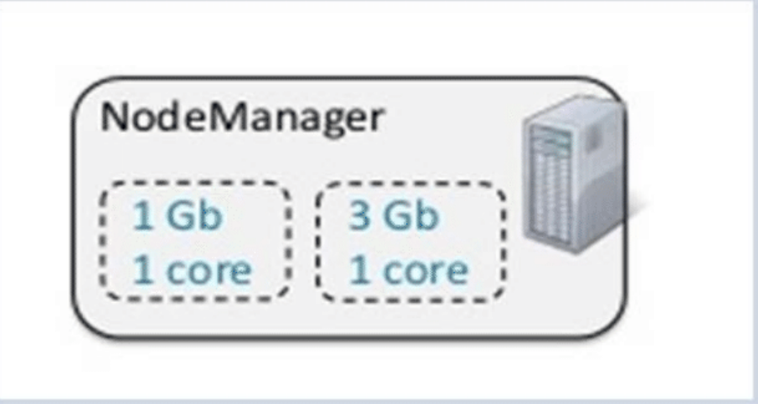
- Runs on the slave node.
- Communicates with RM



Other Important key element in yarn

Containers:

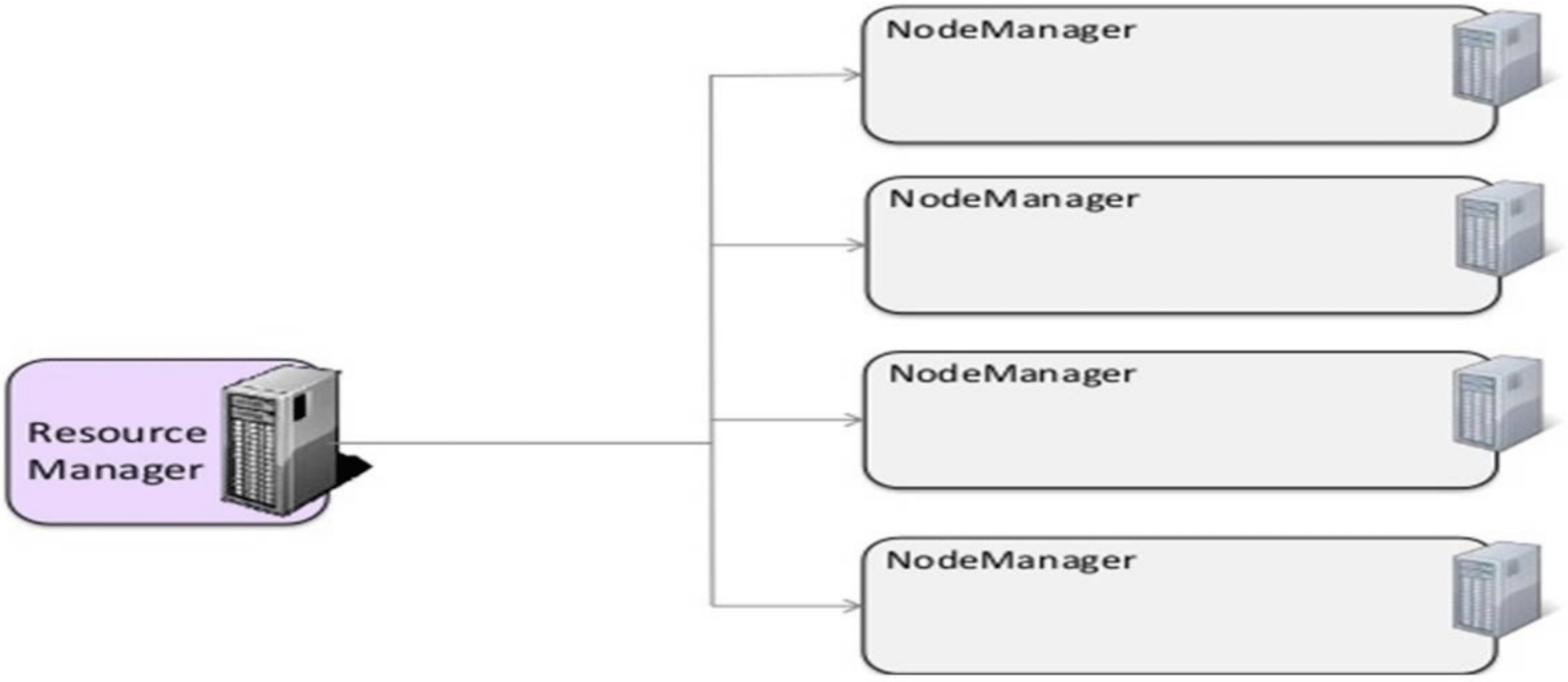
- Allocates a certain amount of resources (memory, cpu) on the slave node
- Application runs on one or more containers



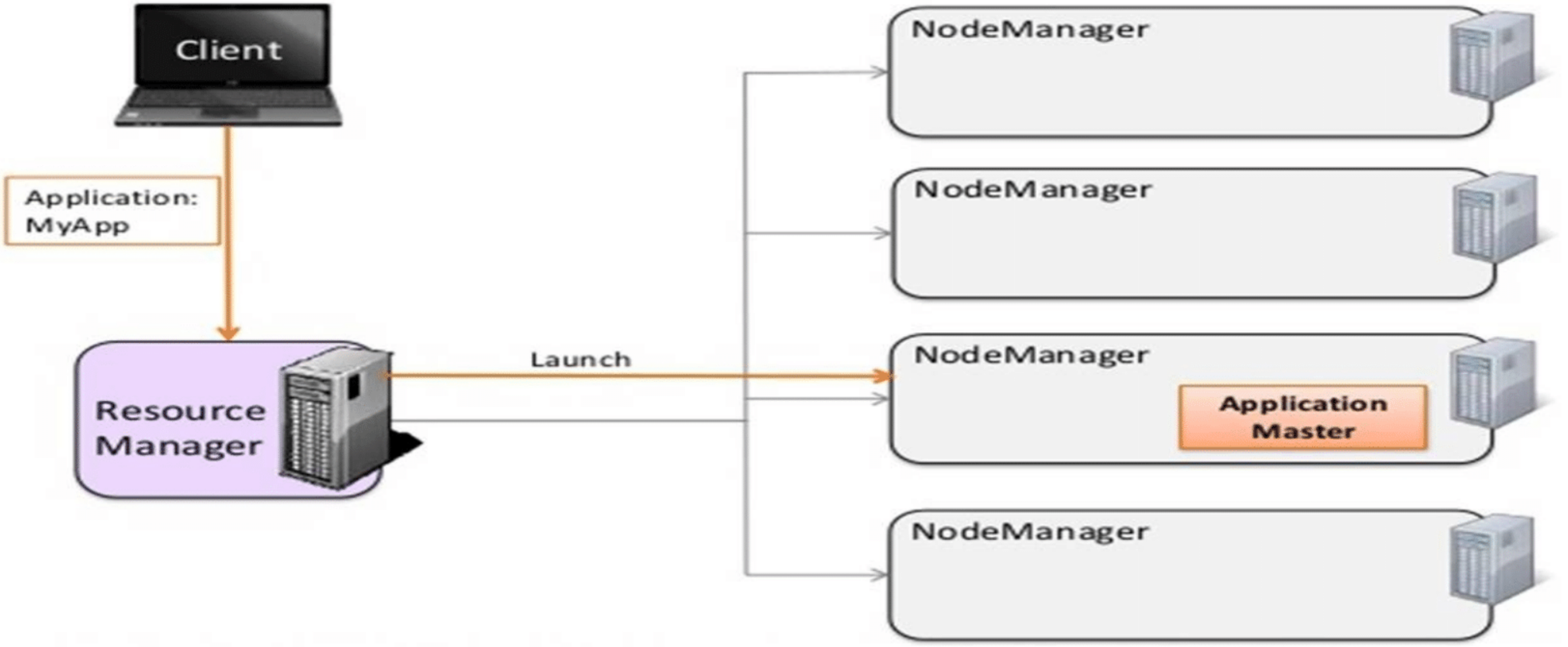
Application master:

- One per application
- Runs in the container
- Request more container to run job

Yarn Cluster



Yarn Cluster Running an application



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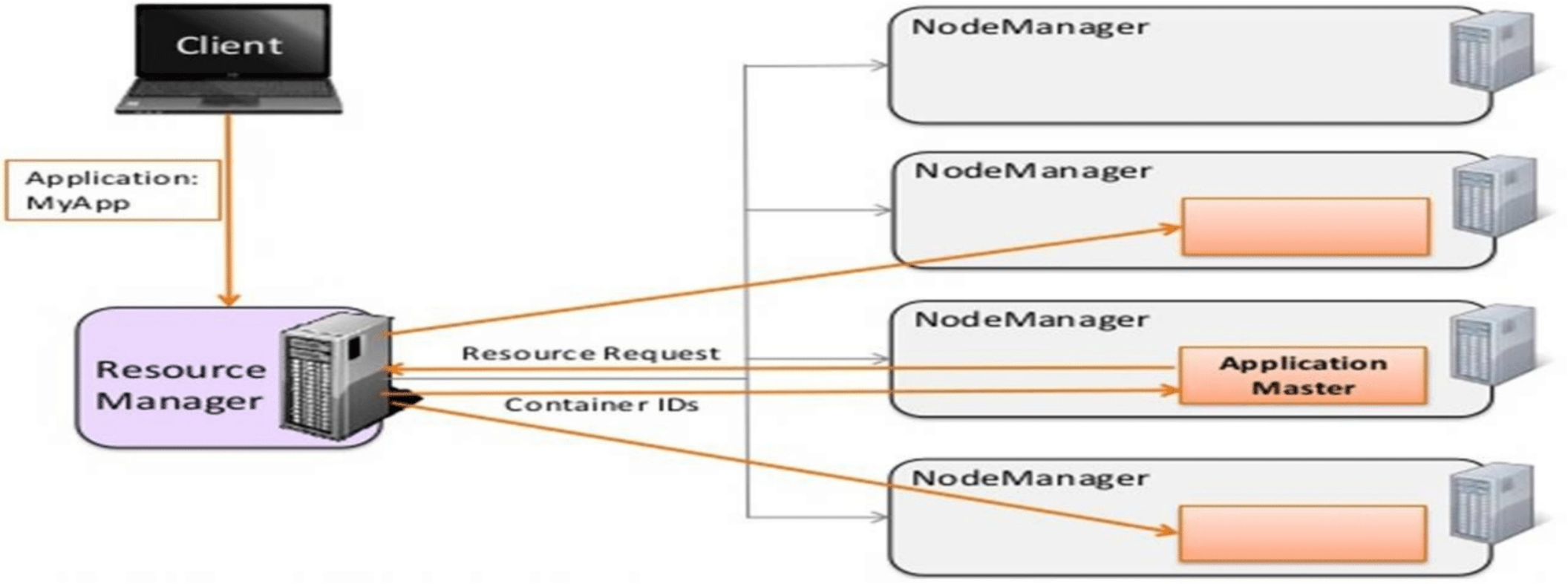

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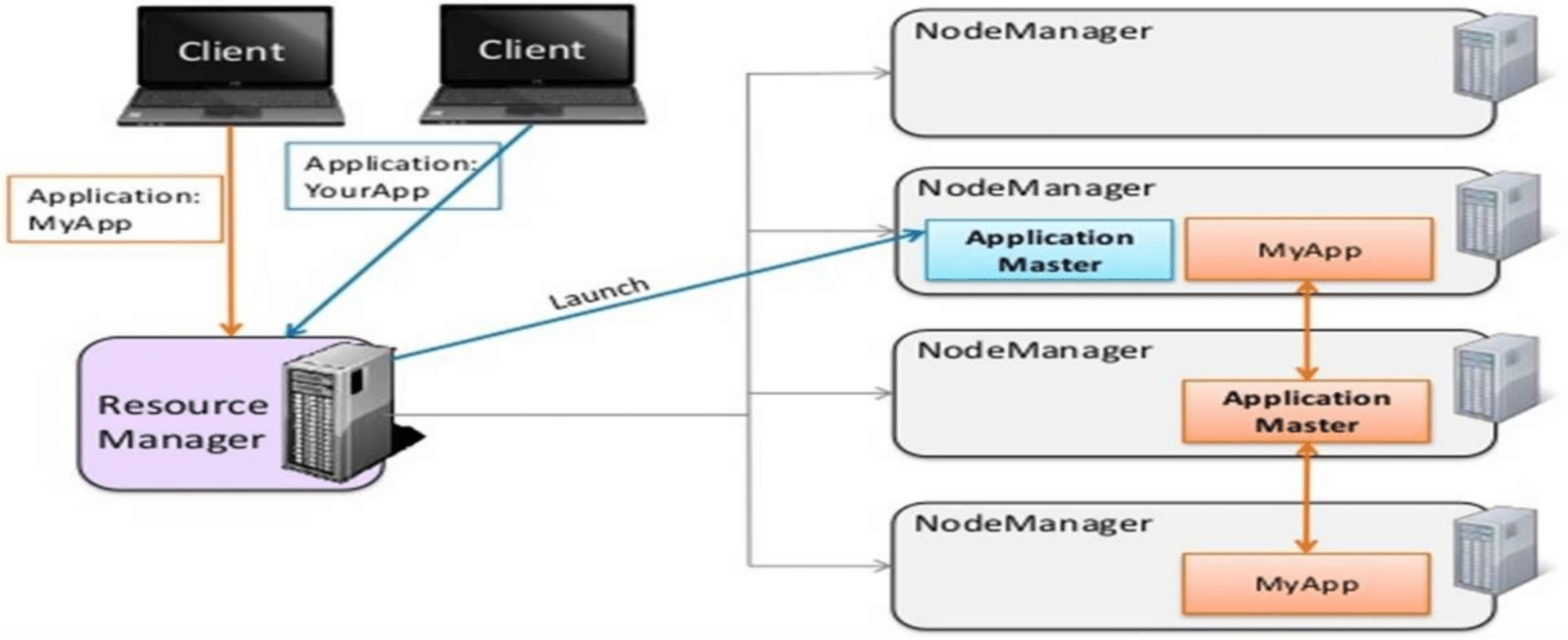

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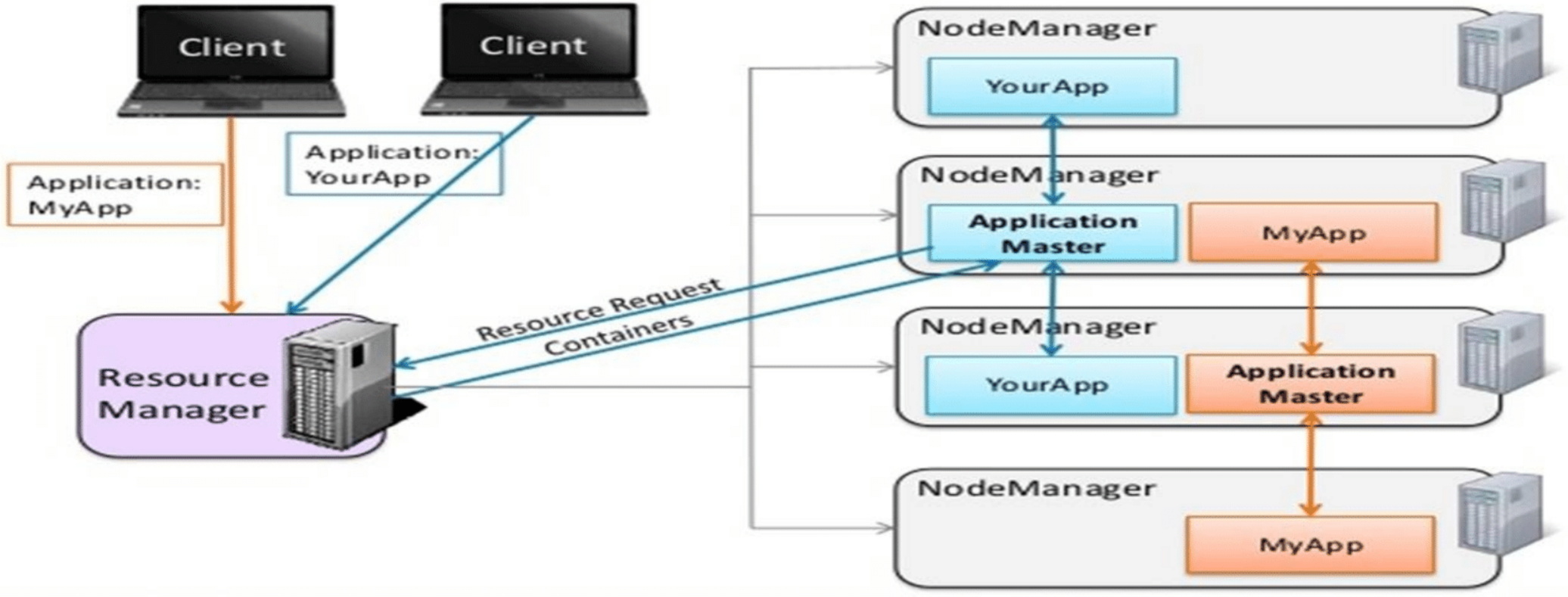


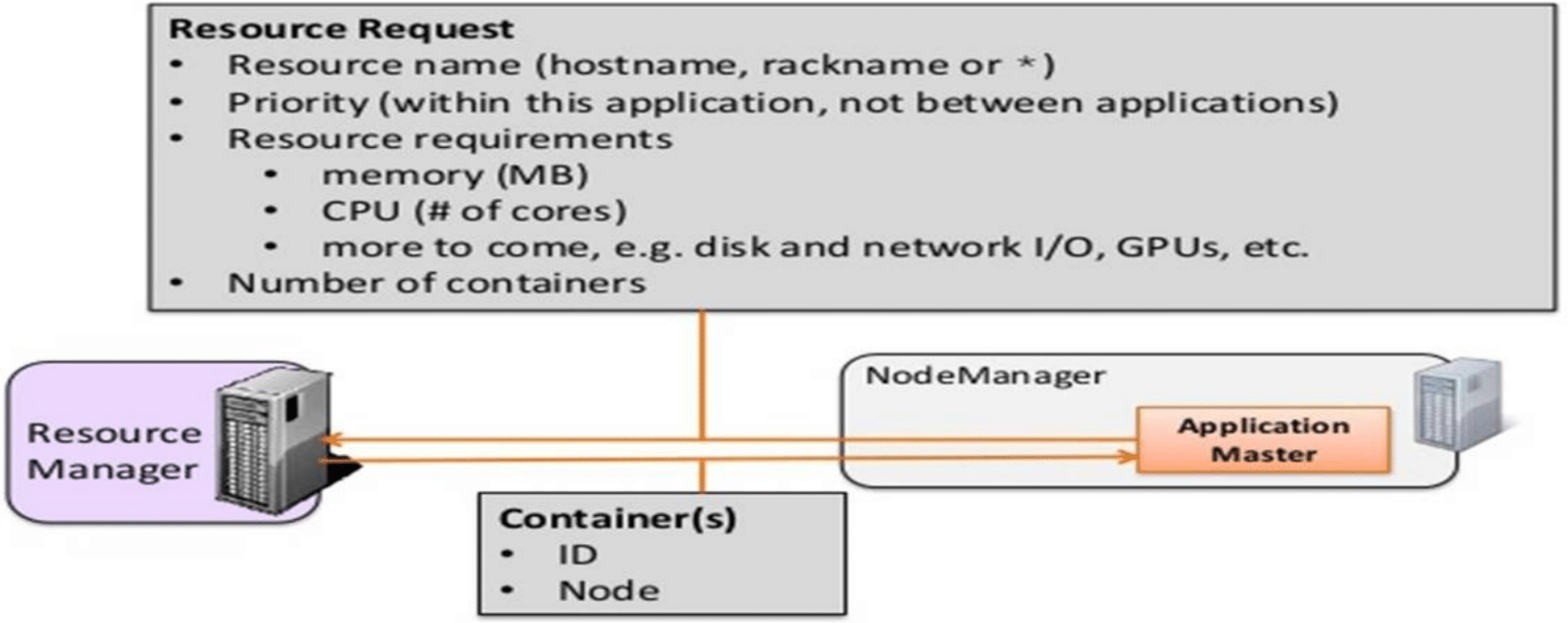
Resource Manager in details

- **What it does**
  - Manages nodes
    - Tracks heartbeats from NodeManagers
  - Manages containers
    - Handles AM requests for resources
    - De-allocates containers when they expire or the application completes
  - Manages ApplicationMasters
    - Creates a container for AMs and tracks heartbeats
  - Manages security
    - Supports Kerberos

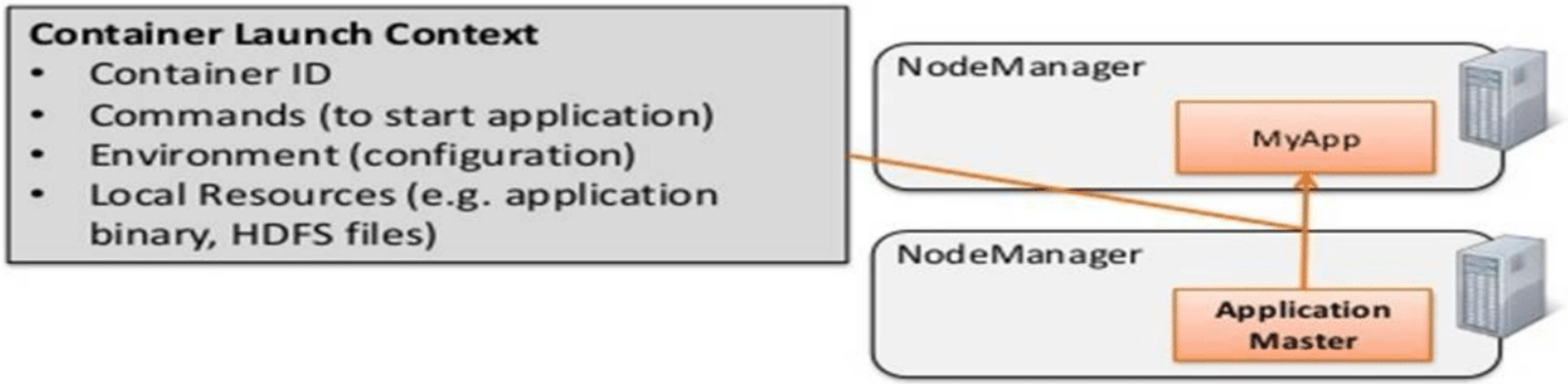
NodeManager in details

- **What it does**
  - Communicates with the RM
    - Registers and provides info on node resources
    - Sends heartbeats and container status
  - Manages processes in containers
    - Launches AMs on request from the RM
    - Launches application processes on request from AM
    - Monitors resource usage by containers; kills run-away processes
  - Provides logging services to applications
    - Aggregates logs for an application and saves them to HDFS
  - Runs auxiliary services
  - Maintains node level security via ACLs

Resource Request

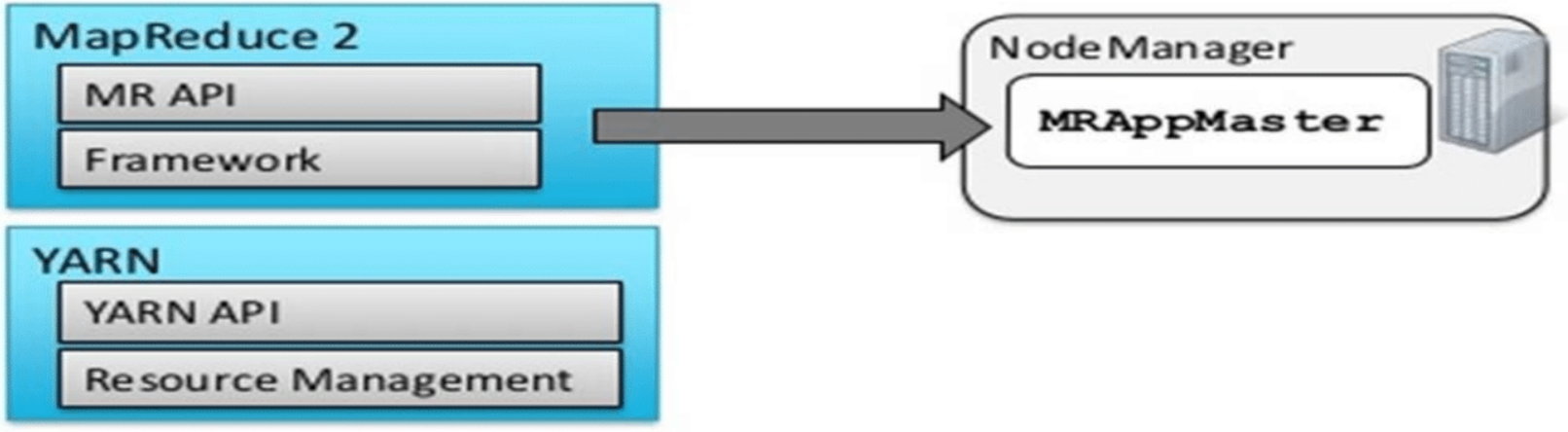


Launch Container

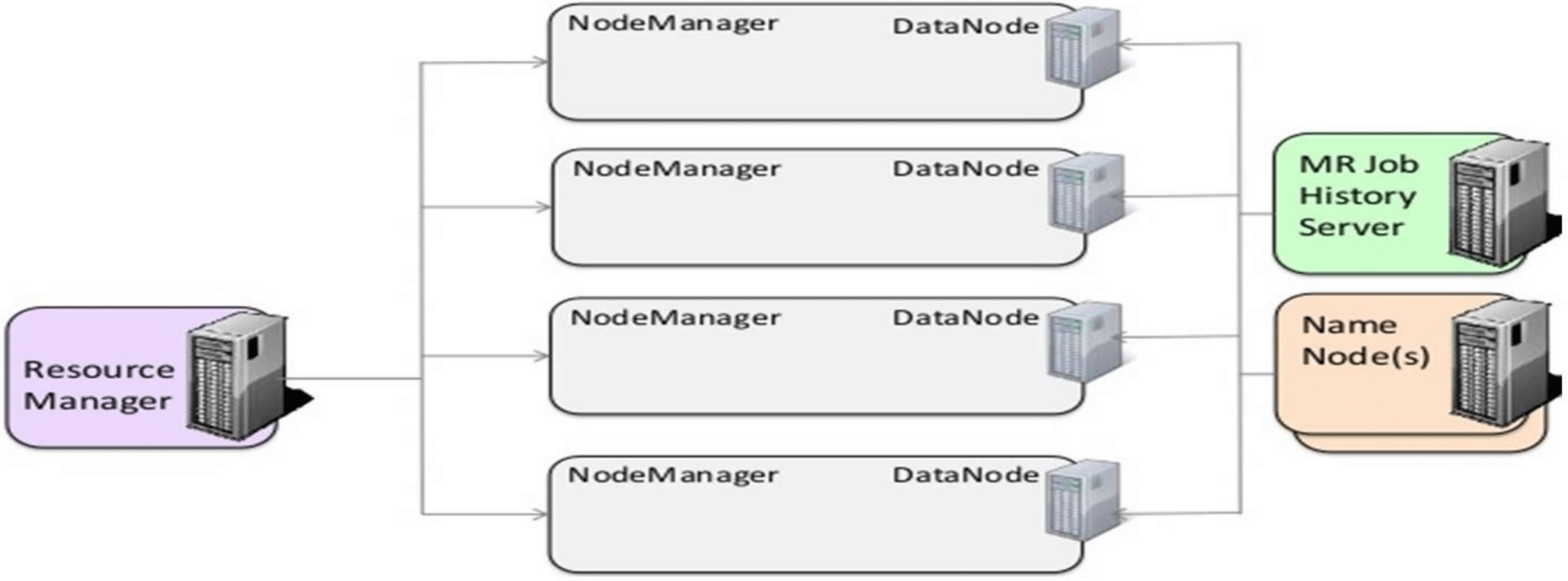


Yarn and Map-Reduce

- **YARN does not know or care what kind of application it is running**
  - Could be MR or something else (e.g. Impala)
- **MR2 uses YARN**
  - Hadoop includes a MapReduce ApplicationMaster (MRAppMaster) to manage MR jobs
  - Each MapReduce job is an a new instance of an application



Running a MapReduce Application



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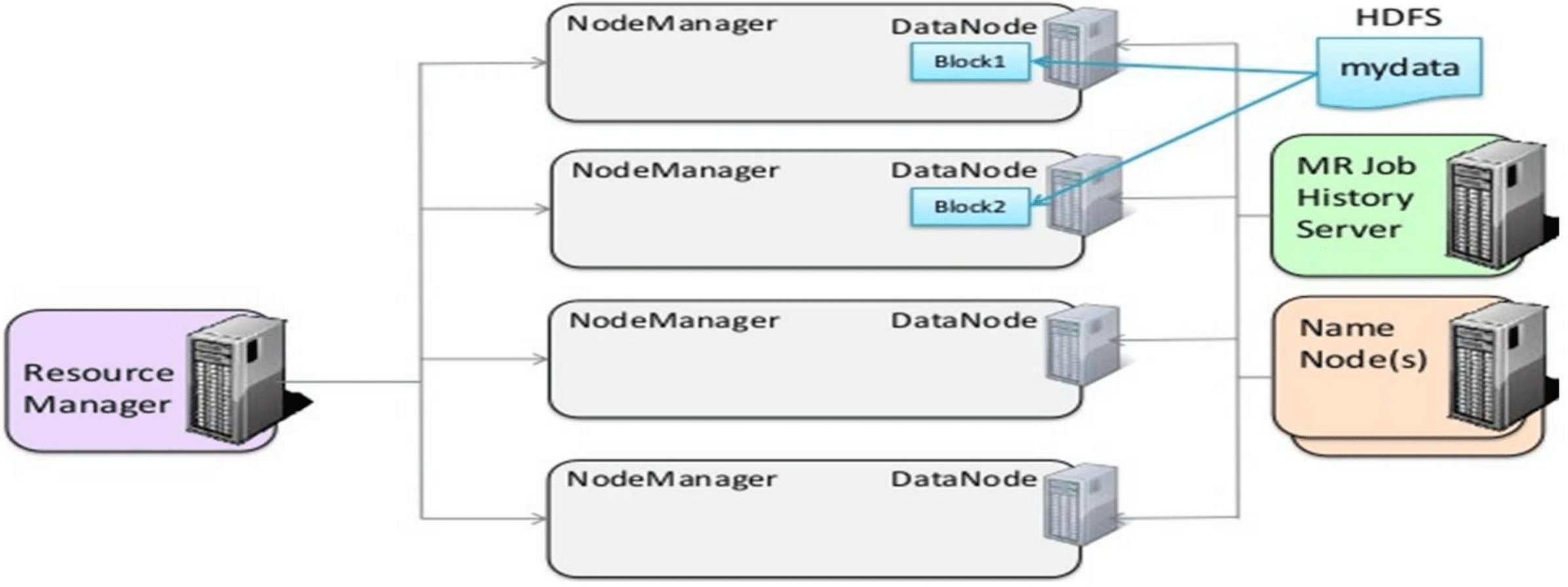

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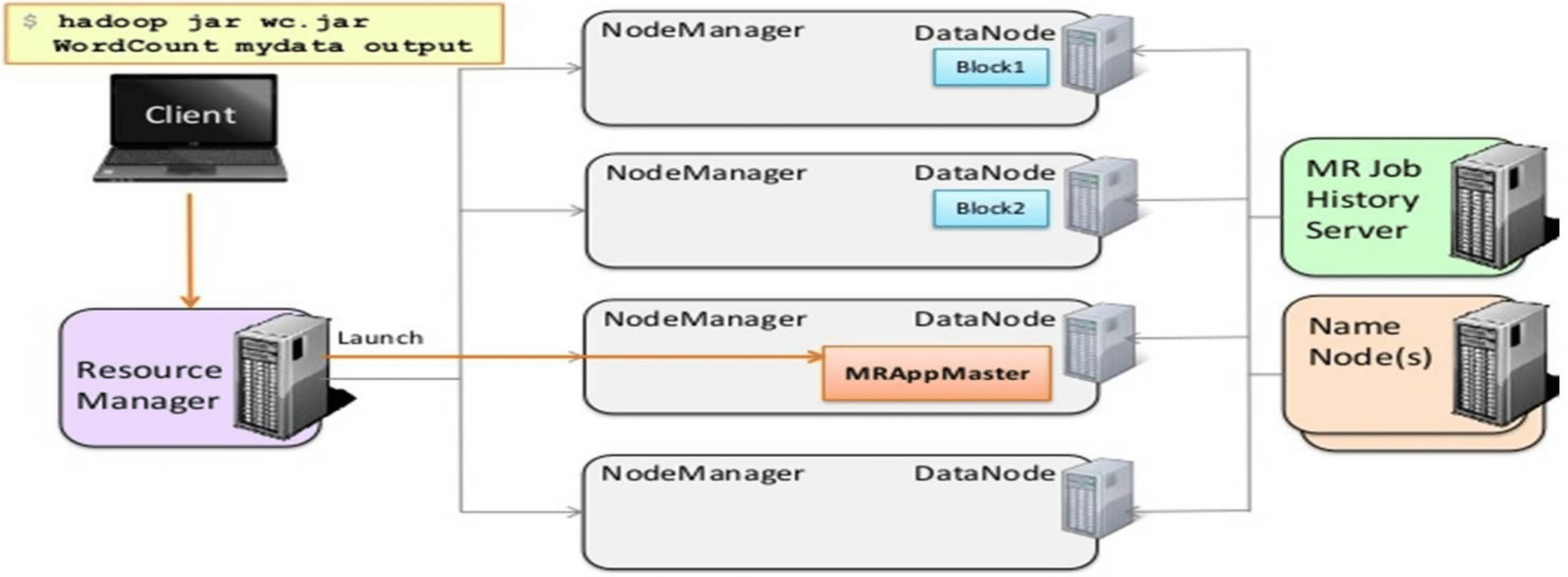

Running a MapReduce Application