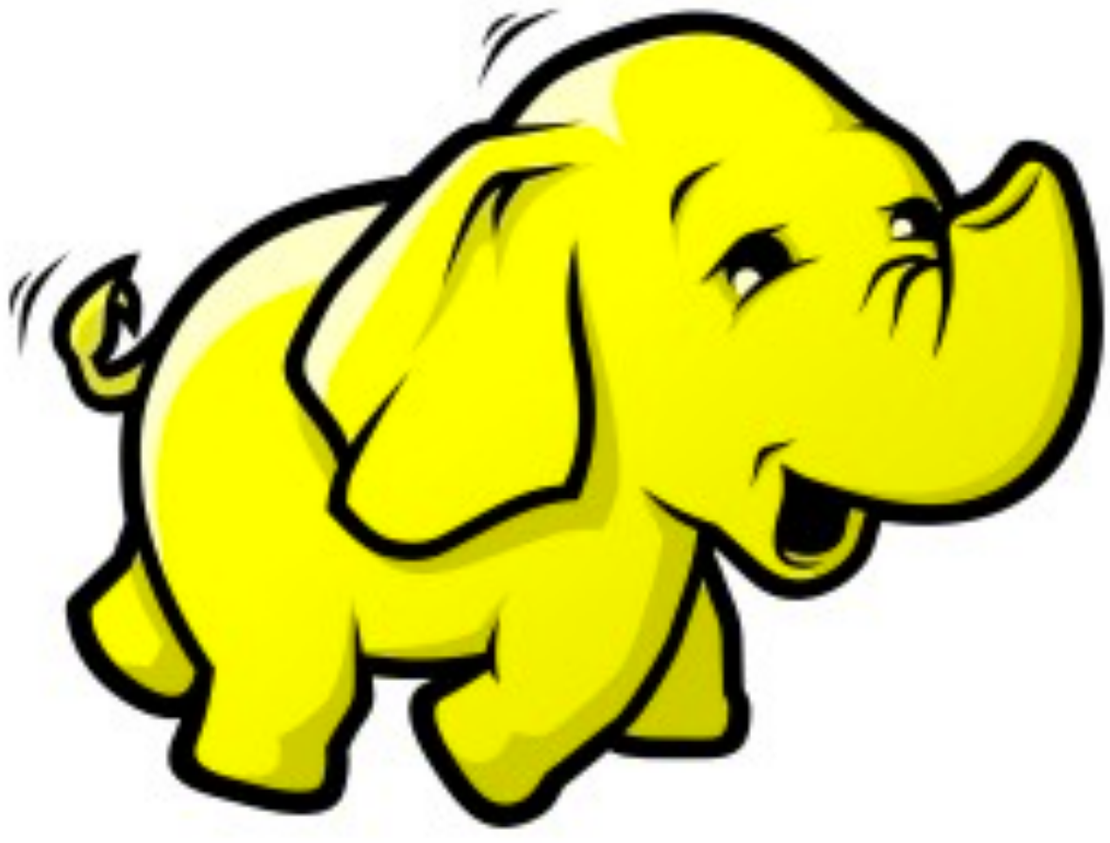
Hadoop YARN

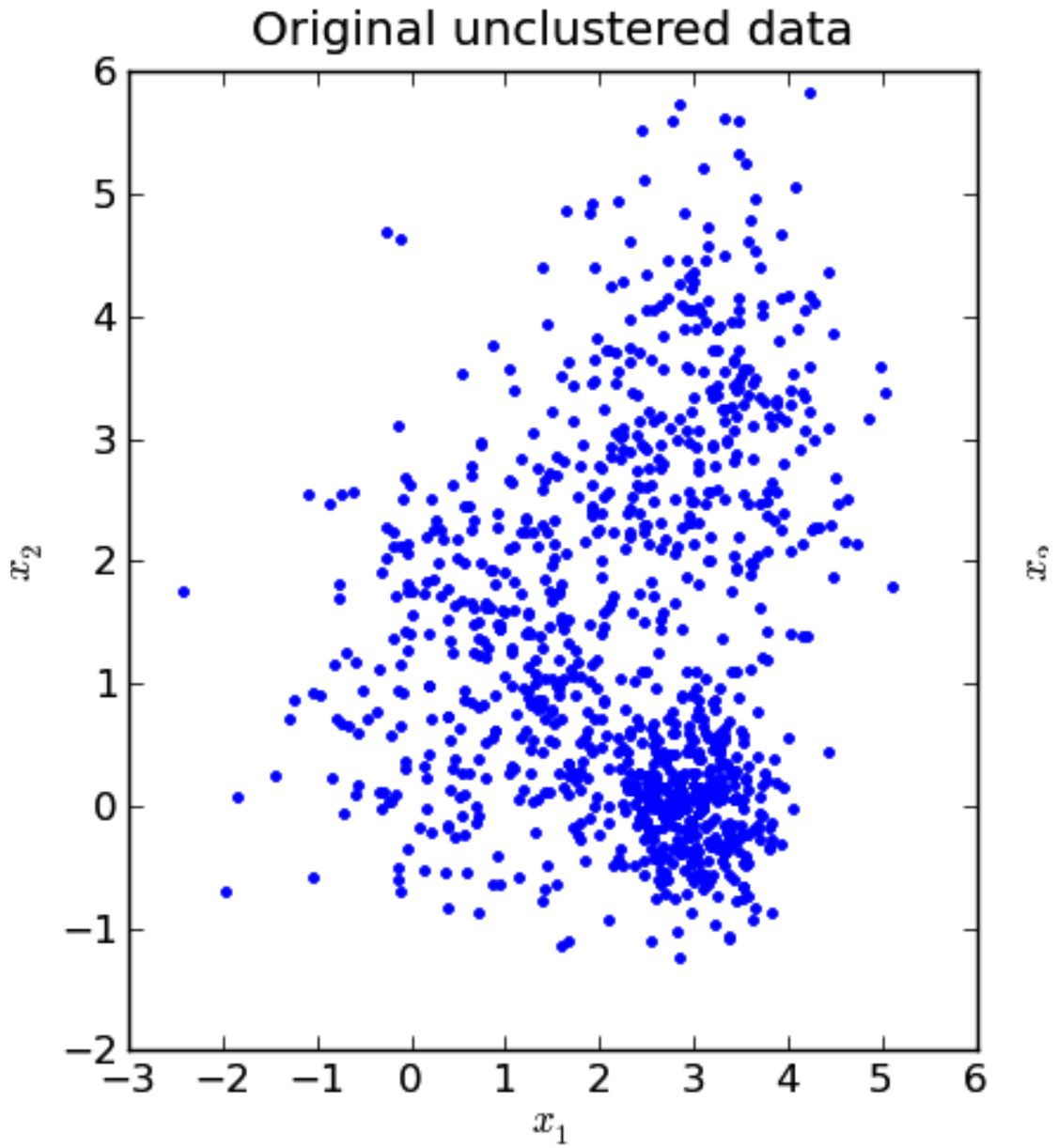
let’s start by reviewing Map/Reduce



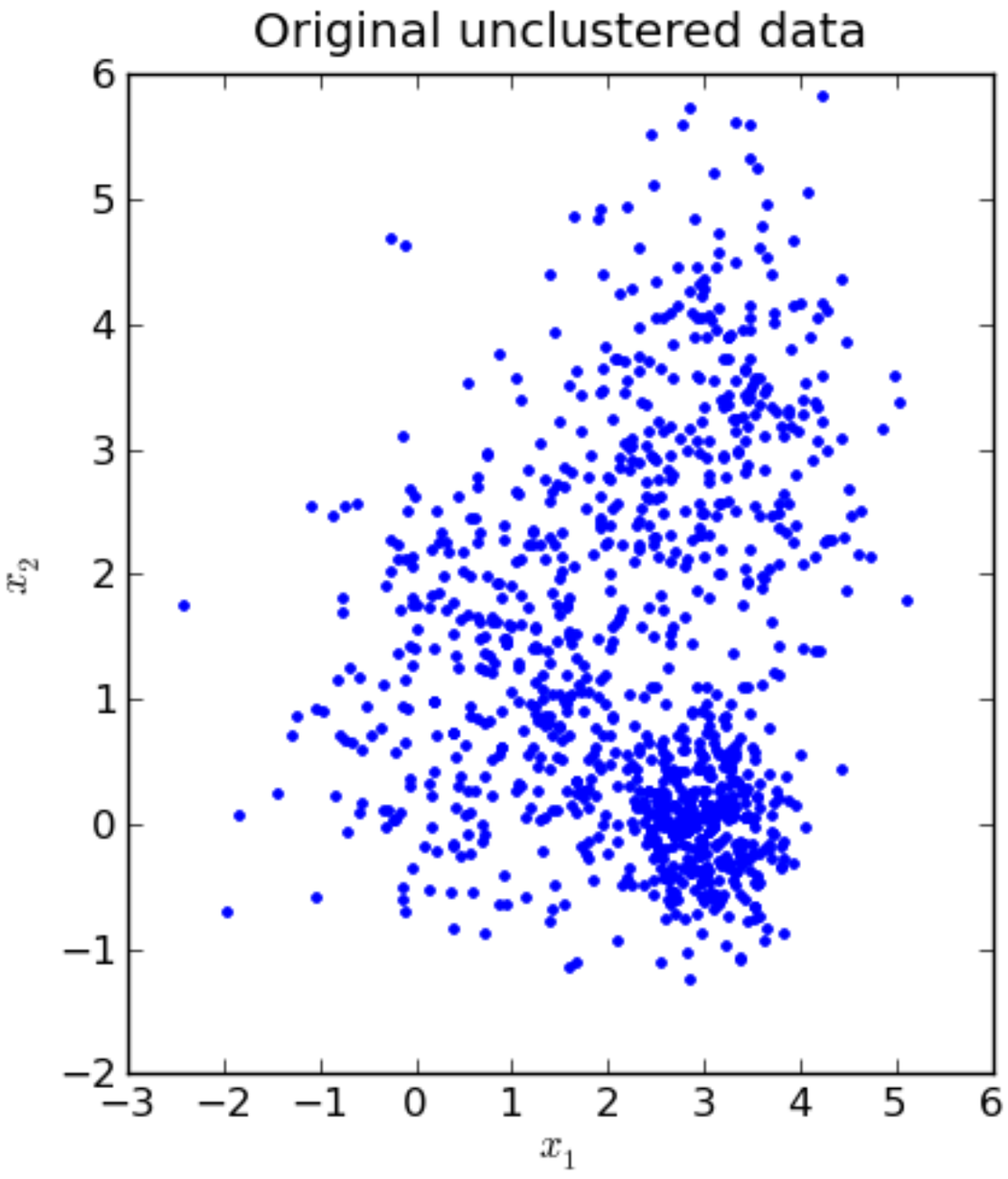
SAY "WORD COUNT"

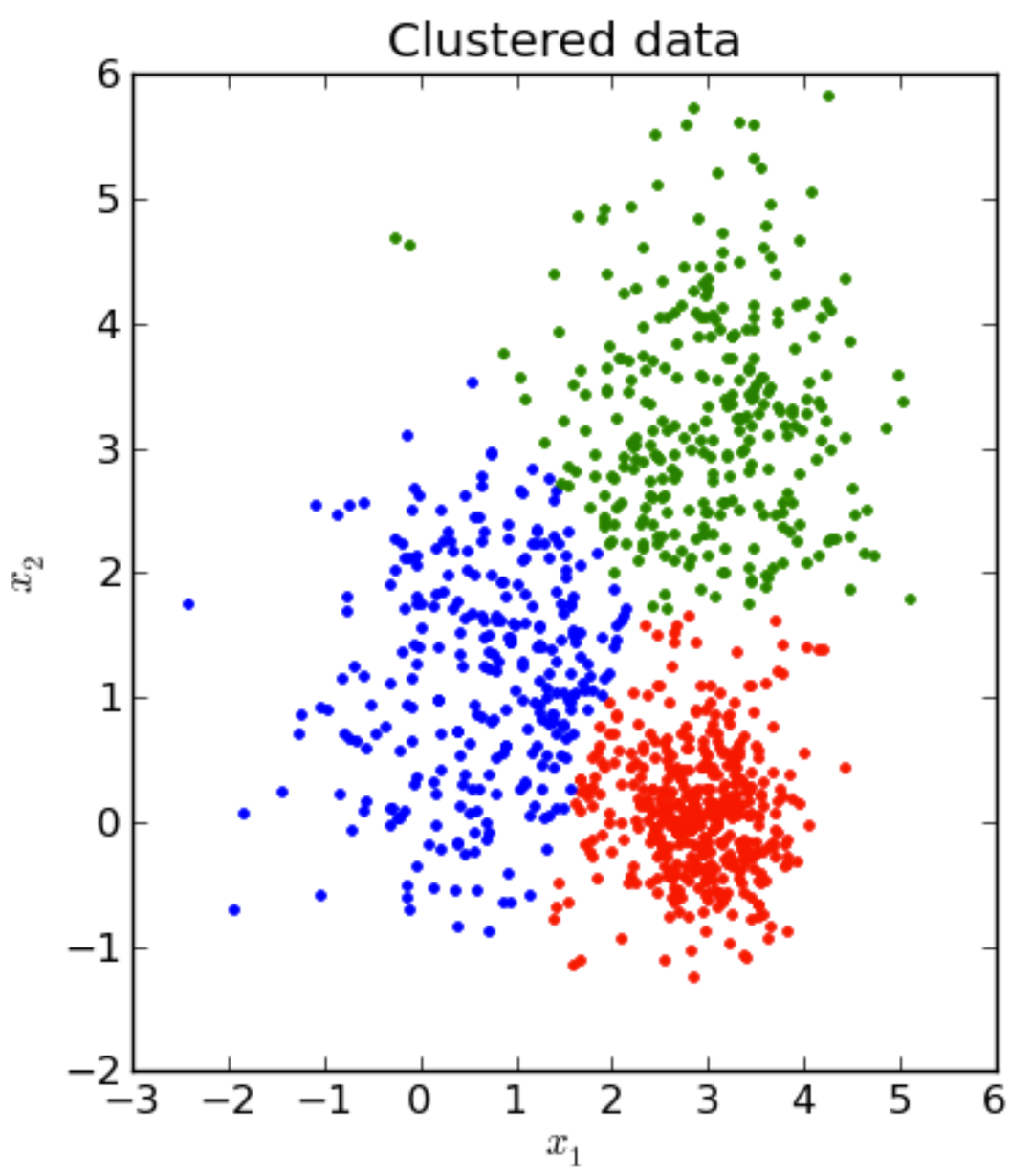
ONE MORE TIME...

ok, ok - K-Means



K=3





```
def perform_kmeans():
    isStillMoving = 1

    initialize_centroids()

    while(isStillMoving):
        recalculate_centroids()
        isStillMoving = update_clusters()

    return
```

put differently

In the map phase

- Read the cluster centers into memory from a File/HBase
- Iterate over each cluster center for each input key/value pair.
- Measure the distances and save the nearest center which has the lowest distance to the vector
- Write the clustercenter with its vector to the context.

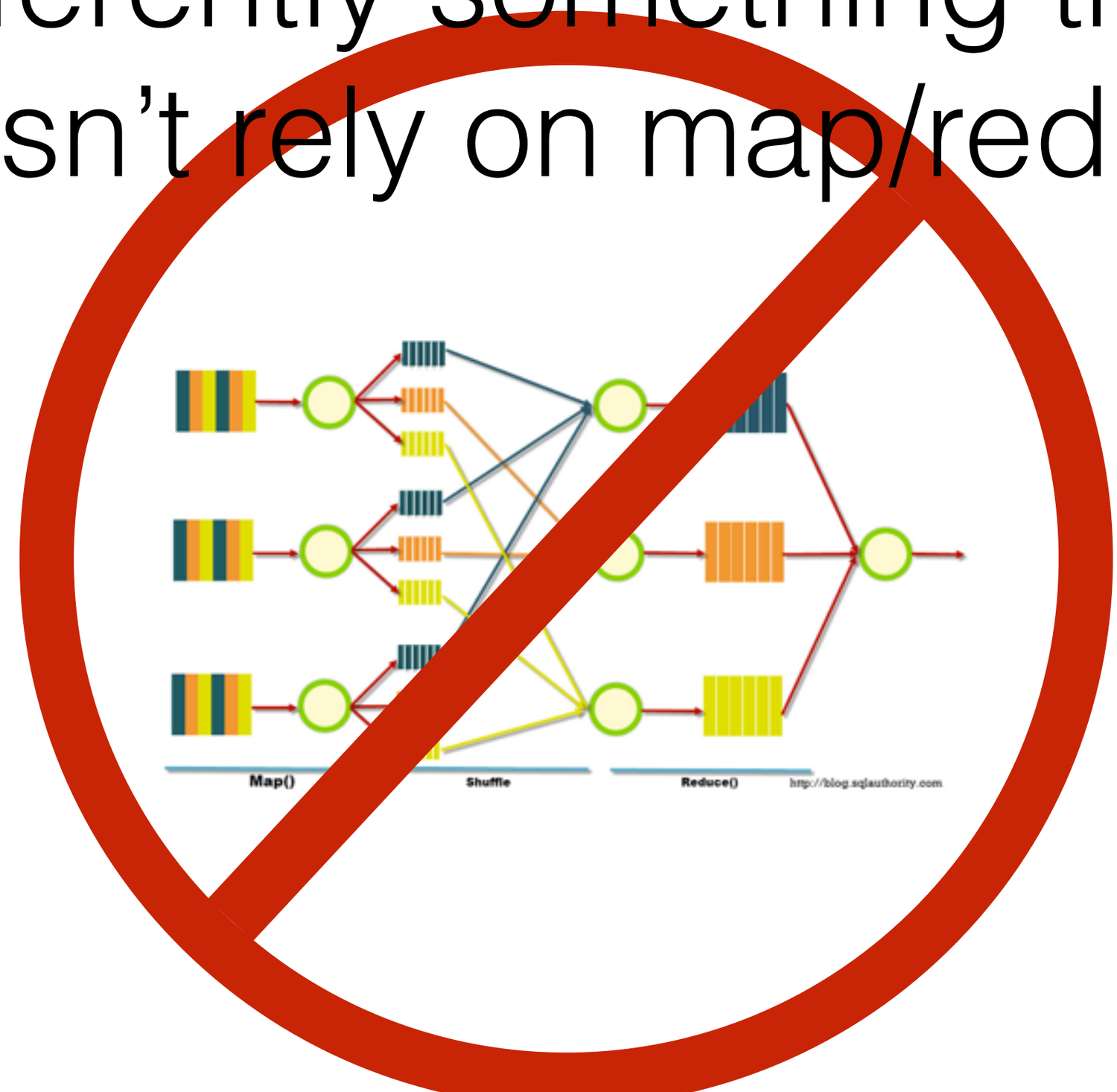
In the reduce phase

- Iterate over each value vector and calculate the average vector. (Sum each vector and devide each part by the number of vectors we received).
- This is the new center, save it into a File/HBase.
- Check if we need the different between runs is < epsilon

Run this whole damn thing again and again

until diff < epsilon

So you want to implement it differently something that doesn't rely on map/reduce



bivm Hadoop Map/Reduce Administration

State: RUNNING
Started: Thu Oct 10 02:57:48 EDT 2013
Version: 1.1.1, rf0025c9fd25730e3c1bfebceeeeb50d930b4fbaa
Compiled: Fri Aug 9 17:06:14 PDT 2013 by jenkins
Identifier: 201310100257
SafeMode: OFF

Cluster Summary (Heap Size is 28.52 MB/2.02 GB)

Running Map Tasks	Running Reduce Tasks	Total Submissions	Nodes	Occupied Map Slots	Occupied Reduce Slots	Reserved Map Slots	Reserved Reduce Slots	Map Task Capacity	Reduce Task Capacity	Avg Tasks/N
0	0	0	1	0	0	0	0	2	1	3.00

Scheduling Information

Queue Name	State	Scheduling Information
default	running	N/A

Filter (Jobid, Priority, User, Name)
Example: 'user:smith 3200' will filter by 'smith' only in the user field and '3200' in all fields

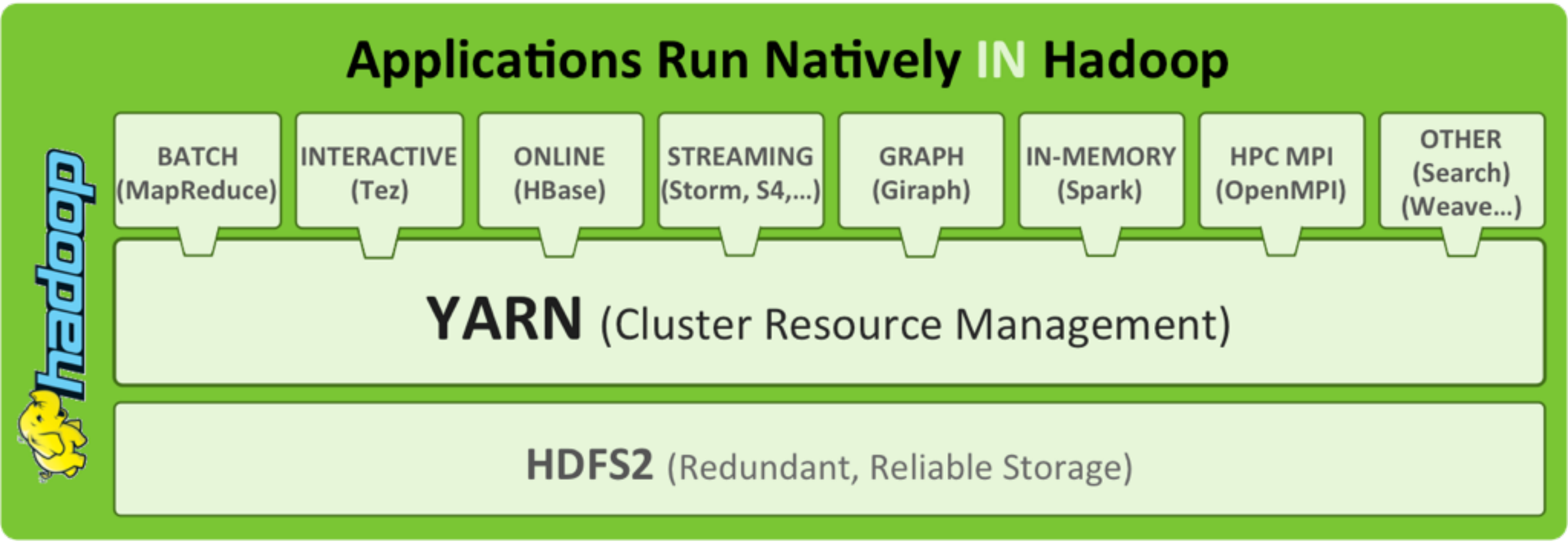
Running Jobs

none

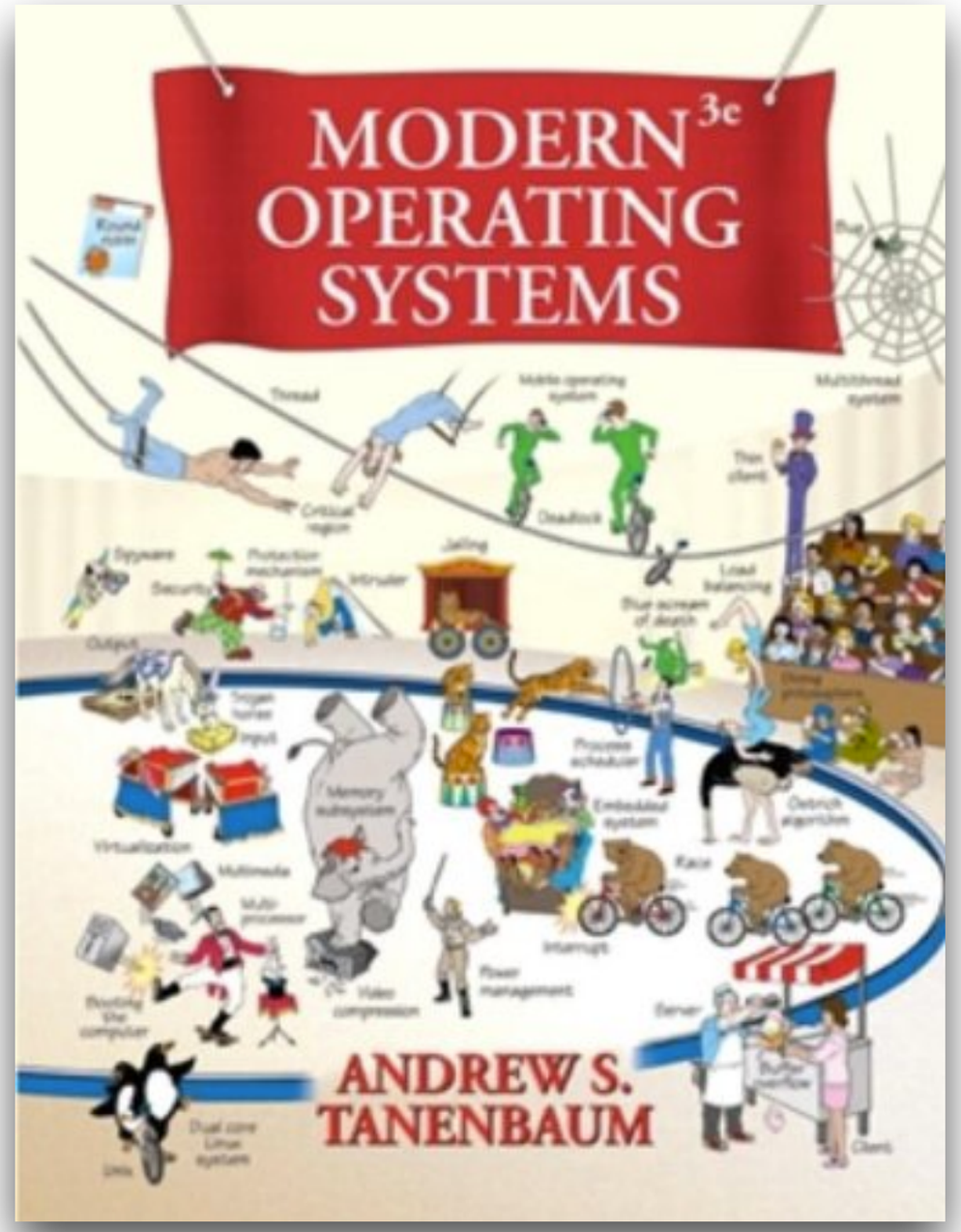
Retired Jobs

Resource management is tied to Map/Reduce

Yet **A**nother **R**esource **N**egotiator



YARN takes Hadoop beyond Map/Reduce

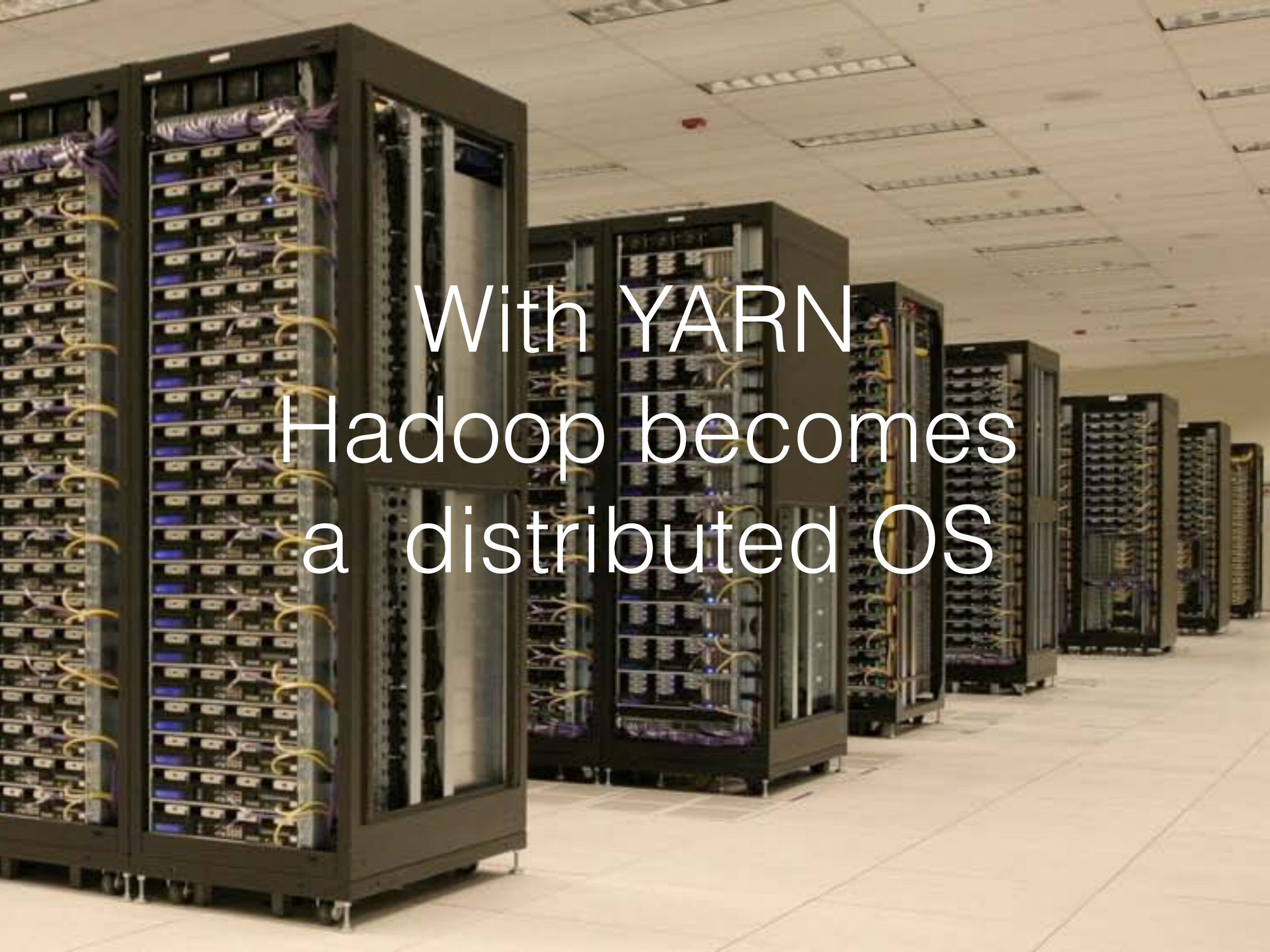


What is an OS?

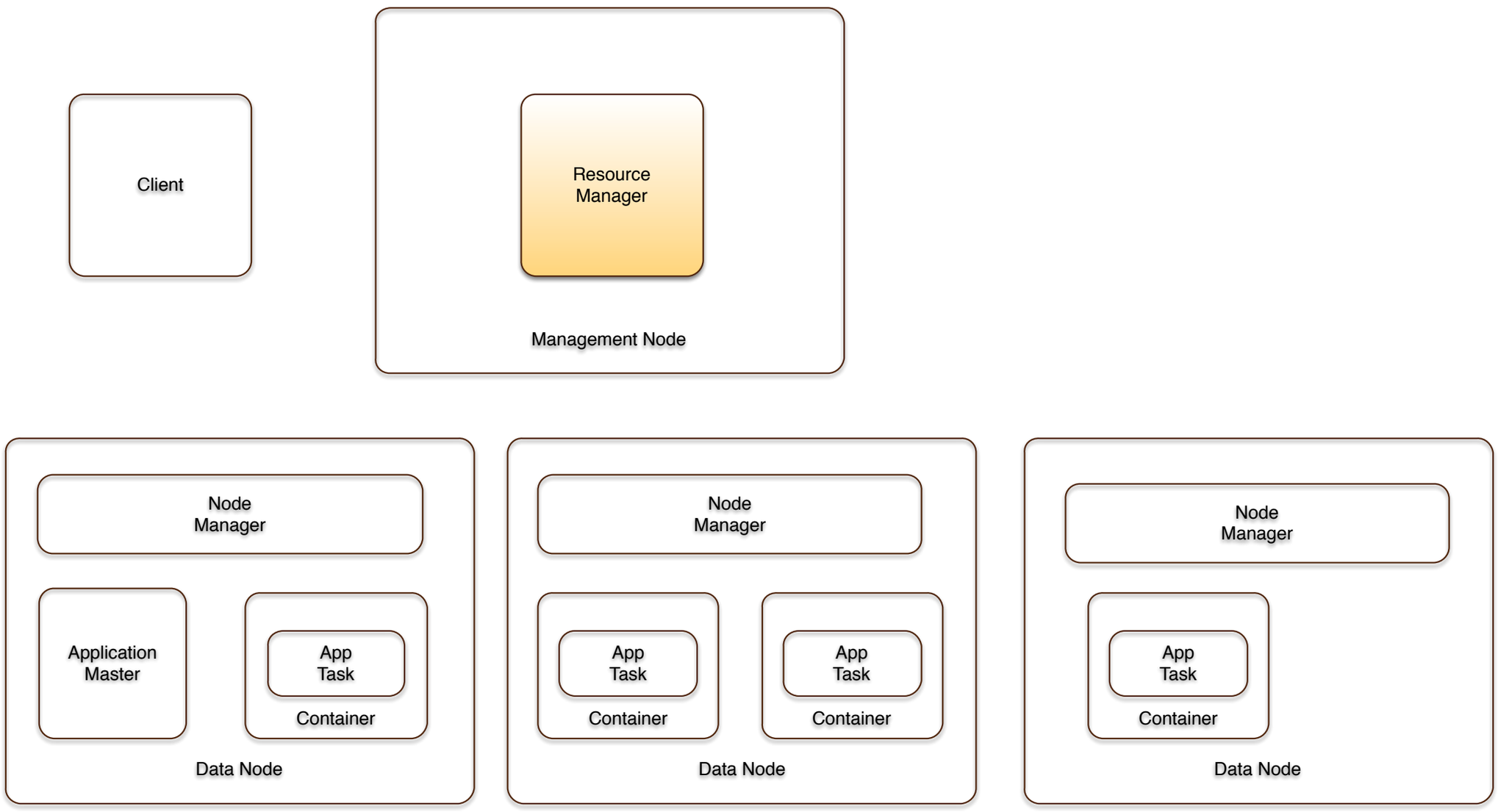
"…the function of the operating system is to present the user with the equivalent of an extended machine or **virtual machine** that is easier to program that the underlying hardware"

“…The Operating System as a

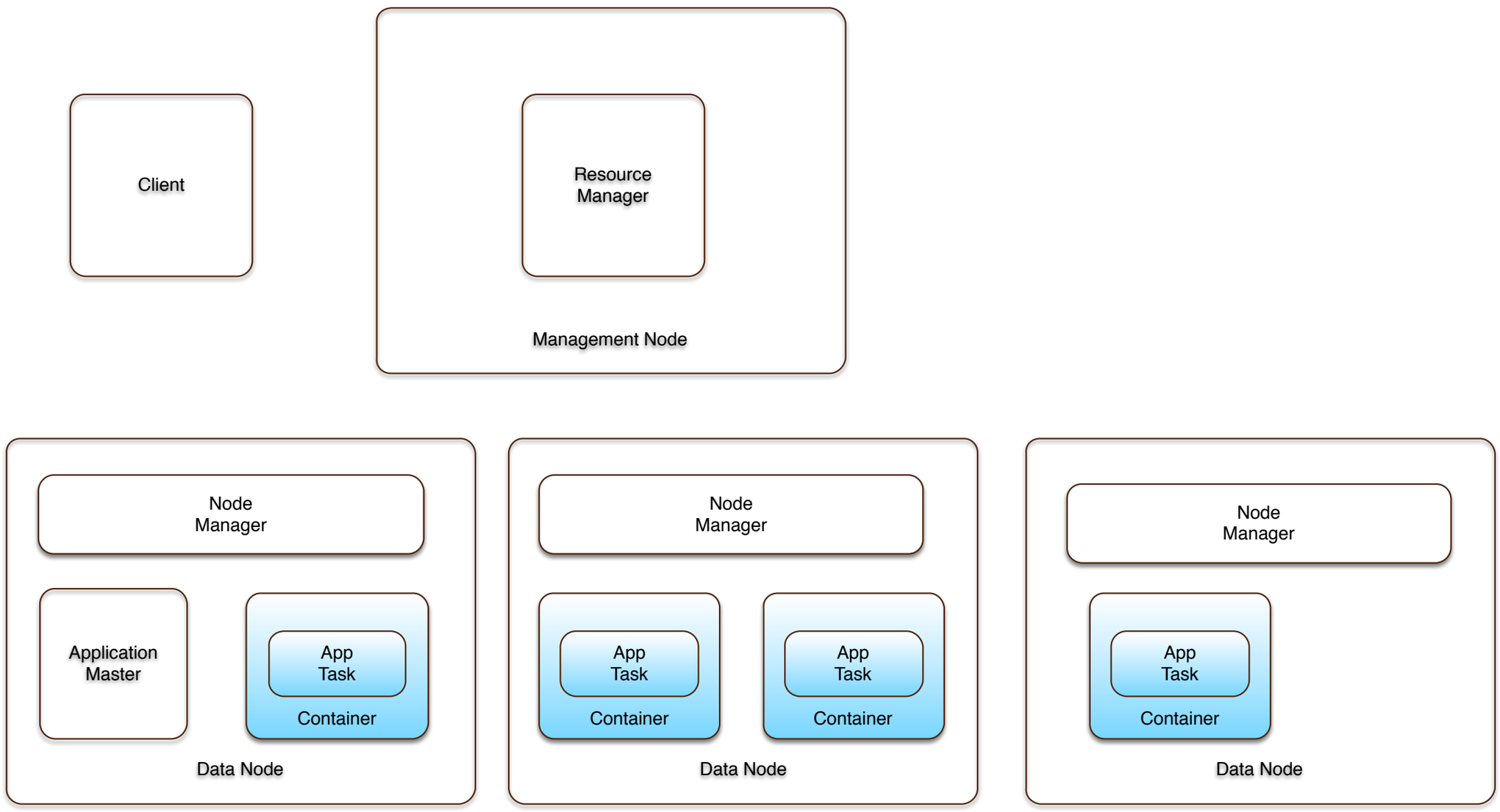
Resource Manager… the job of the operating system is to provide for an orderly and controlled allocation of the processors, memories, and/or devices among the various programs competing for them”


With YARN
Hadoop becomes
a distributed OS

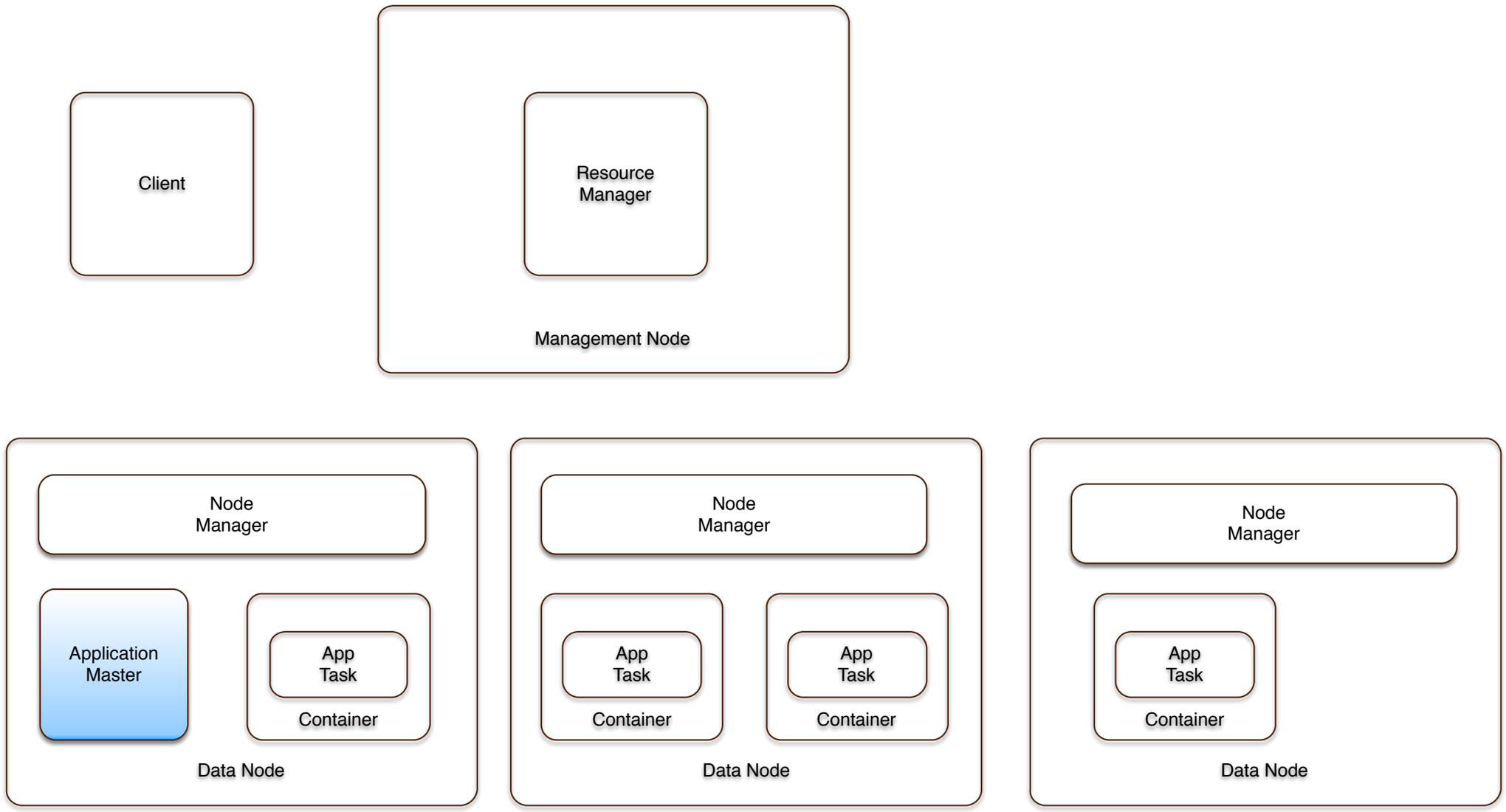
The **Resource Manager** is essentially a scheduler



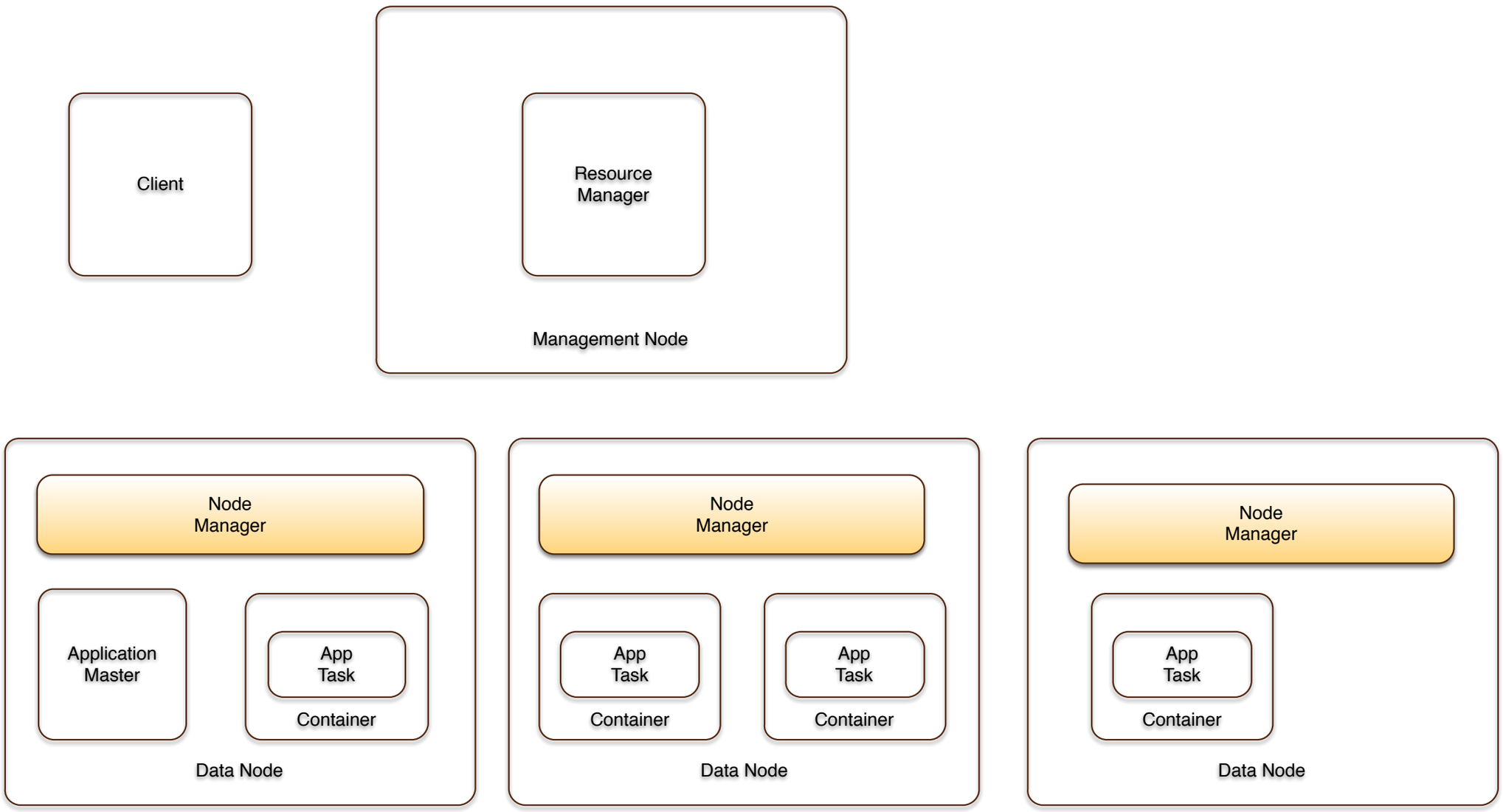
Containers are allocations of physical resources



Each app instance spawns an **application manager** (container 0) - to negotiate resource and and monitor app progress (tasks)

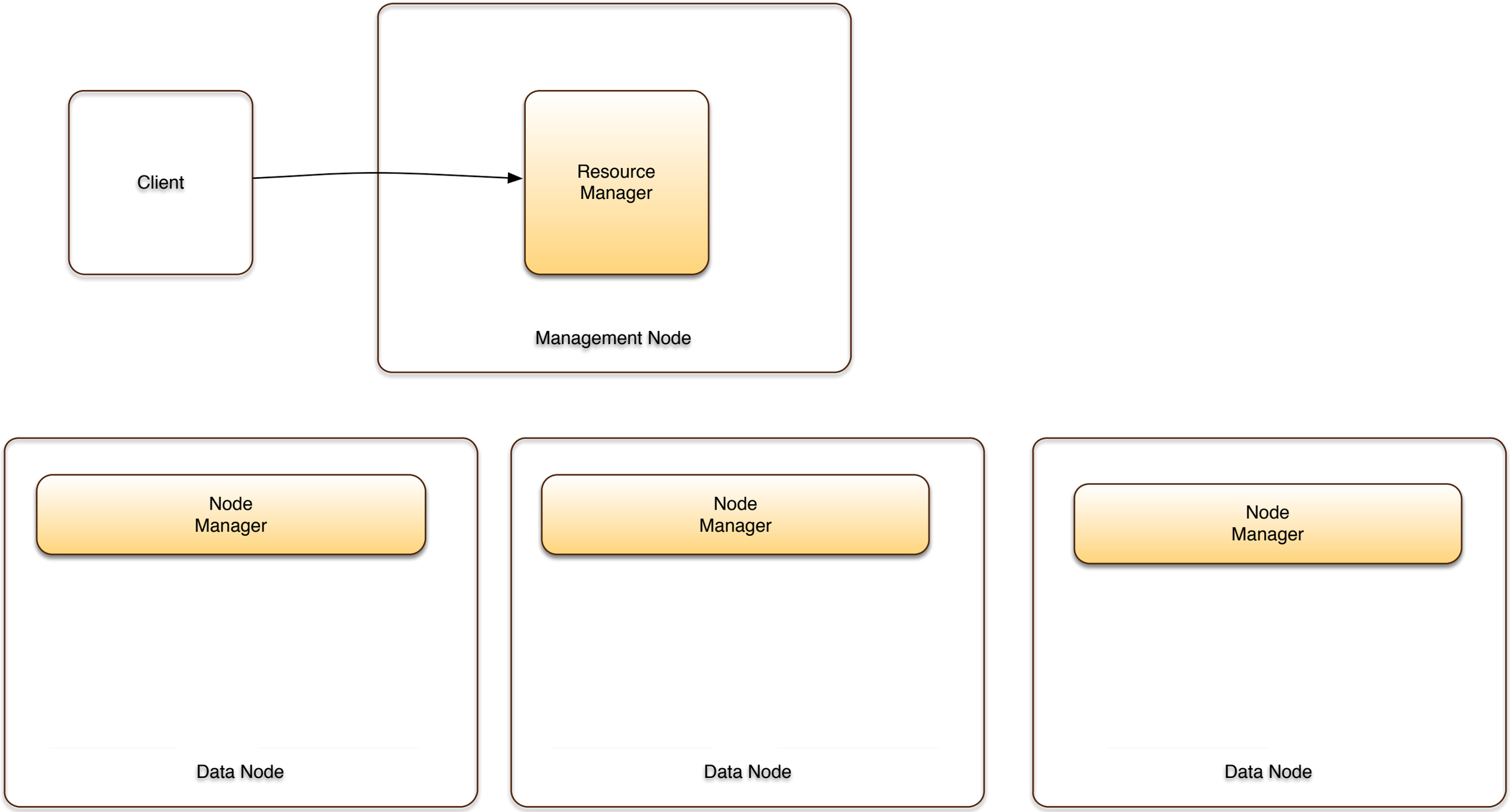


Node managers monitor nodes and manage containers lifecycle

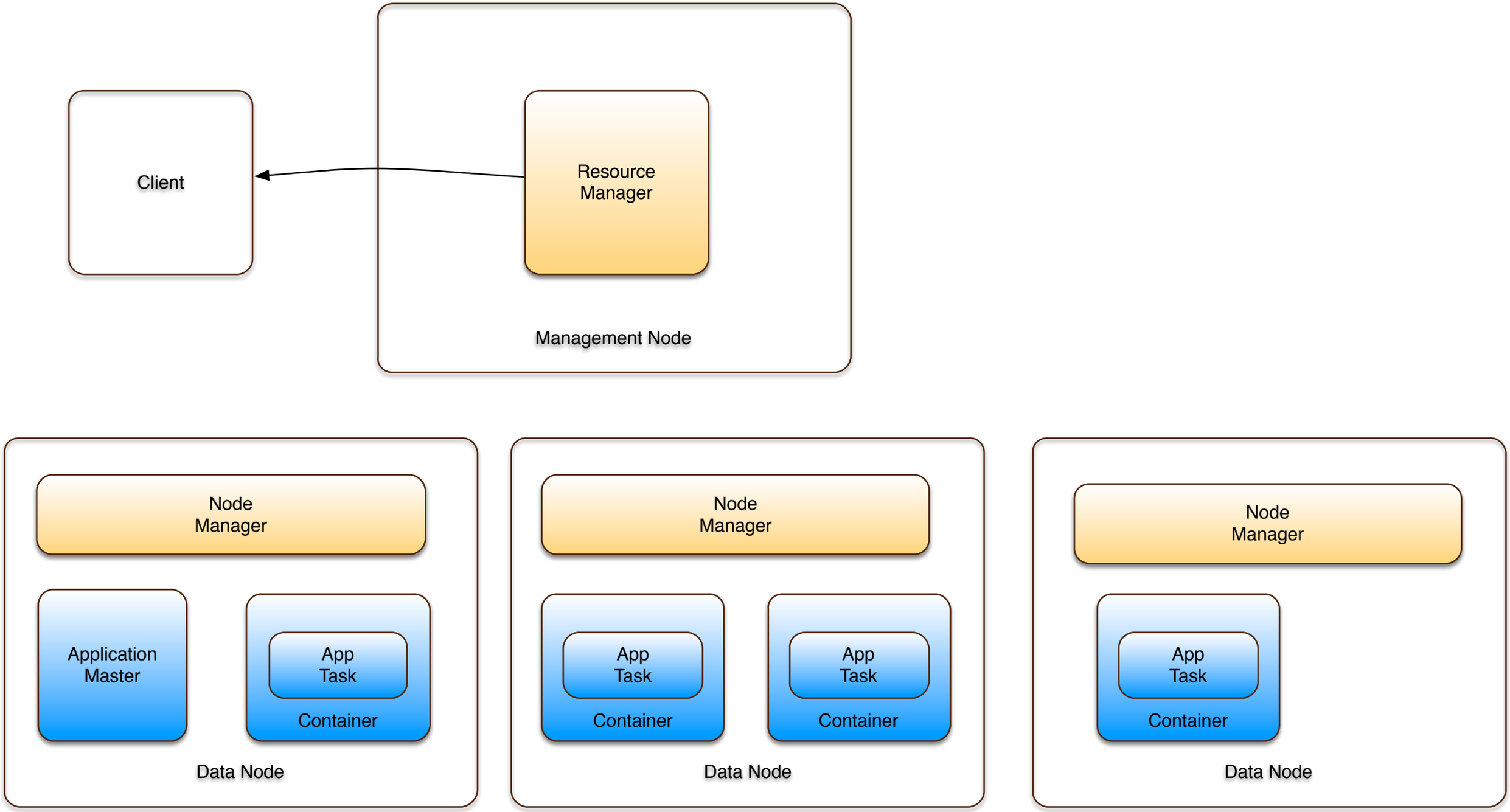


Application Initiation

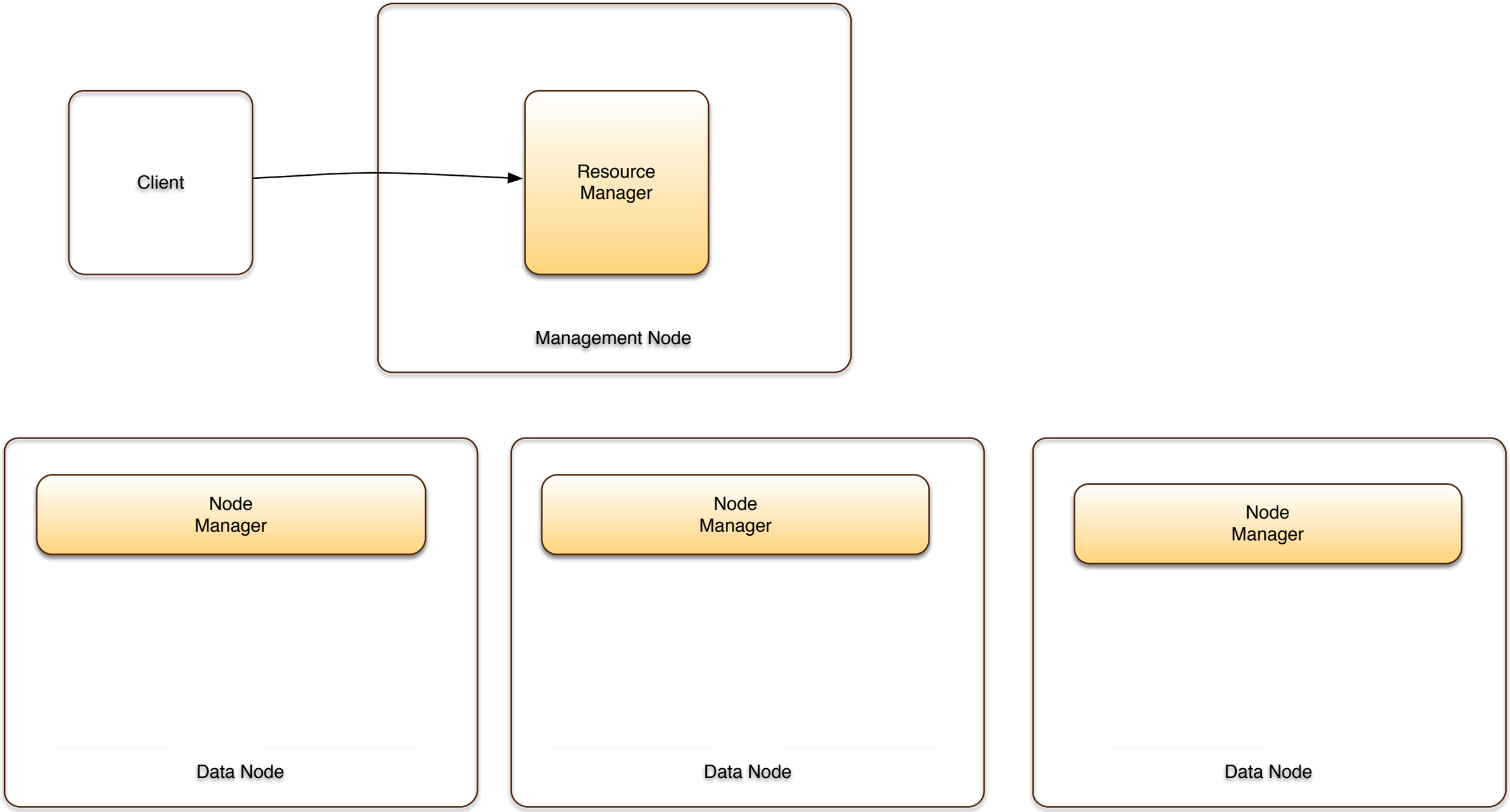
(or “how to get an App running in 11 easy steps”)



1. Client submits a job/app

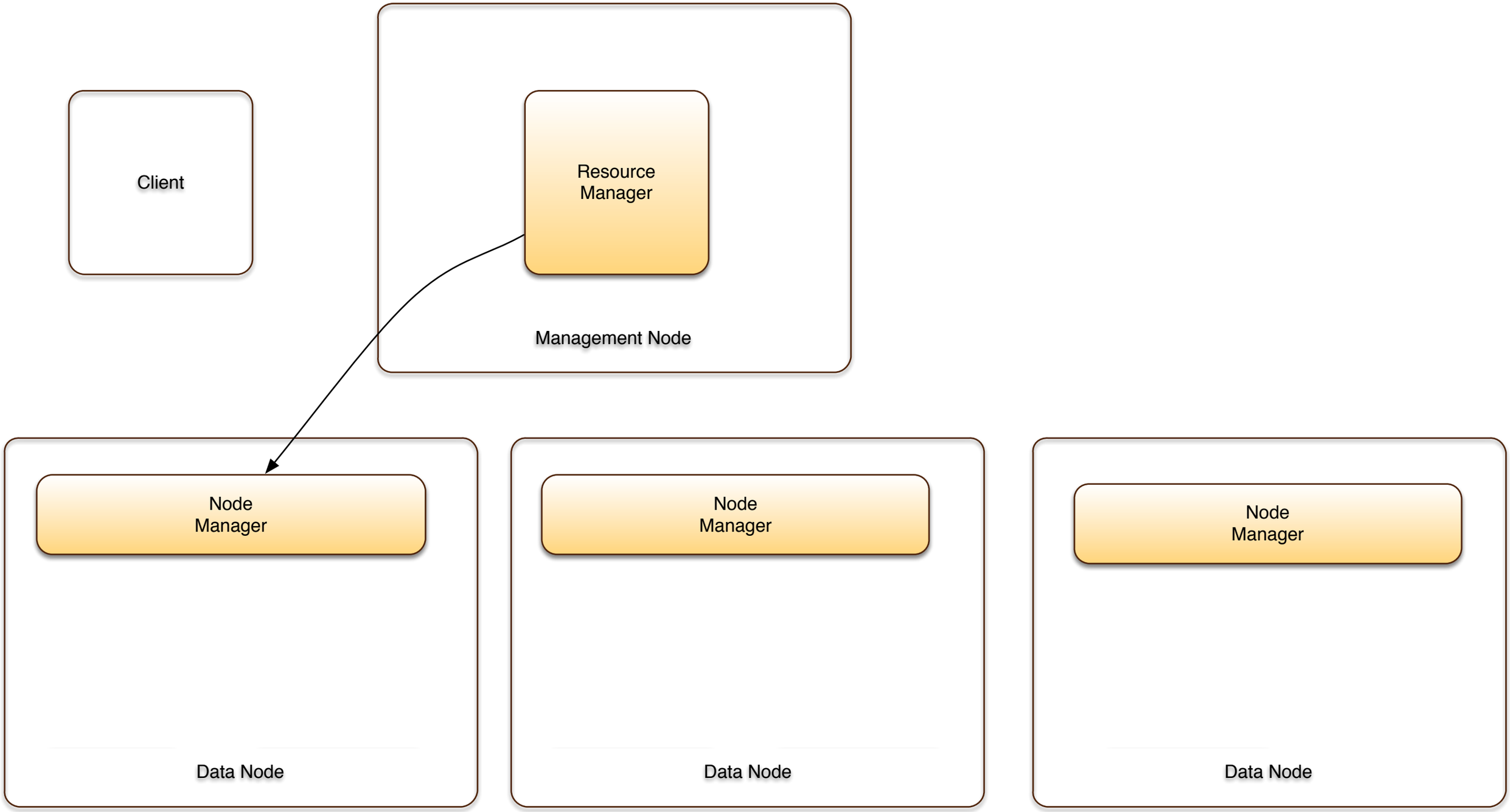


2. Resource Manager (RM) provides Application Id

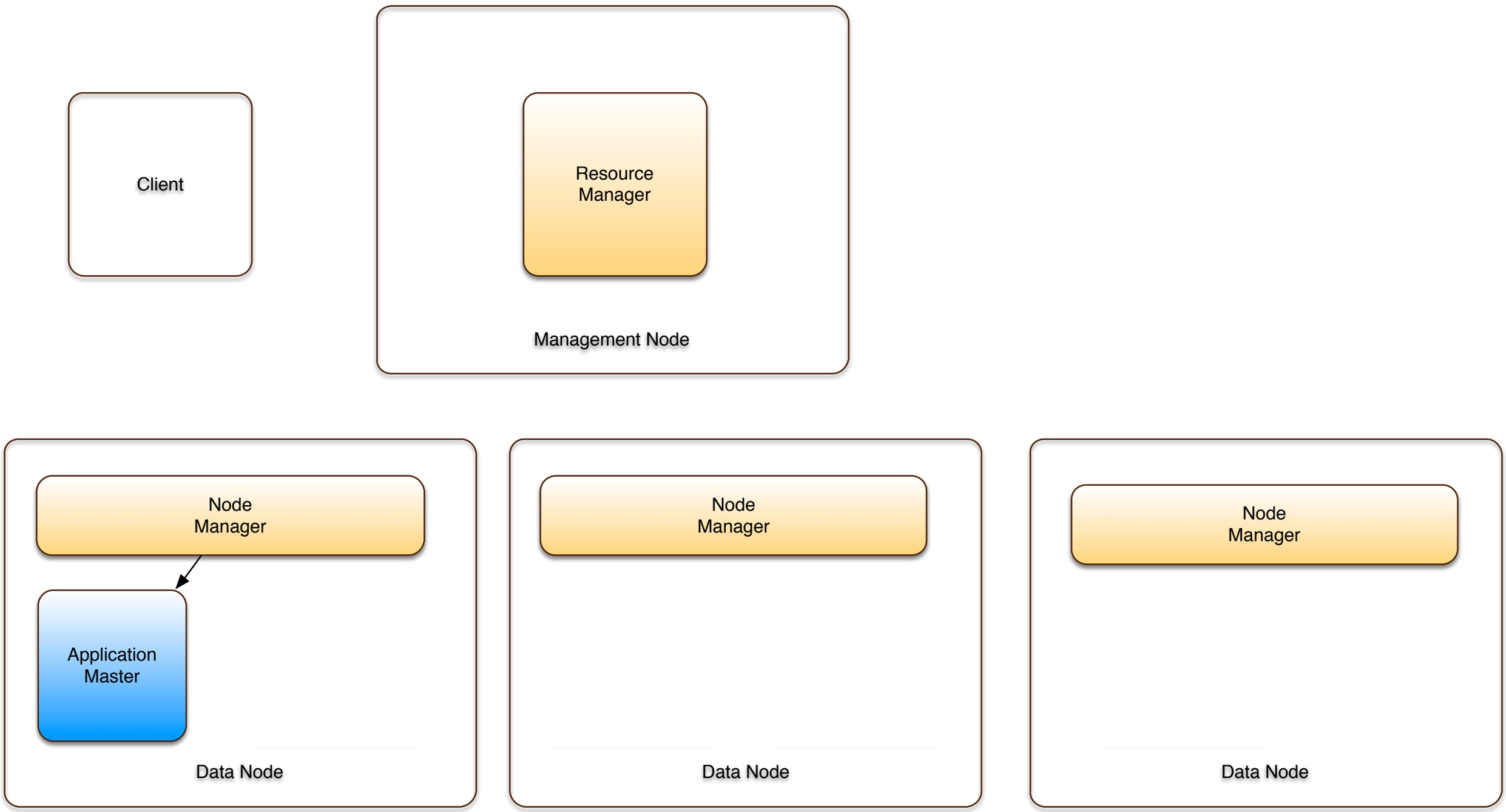


3. Client provides context

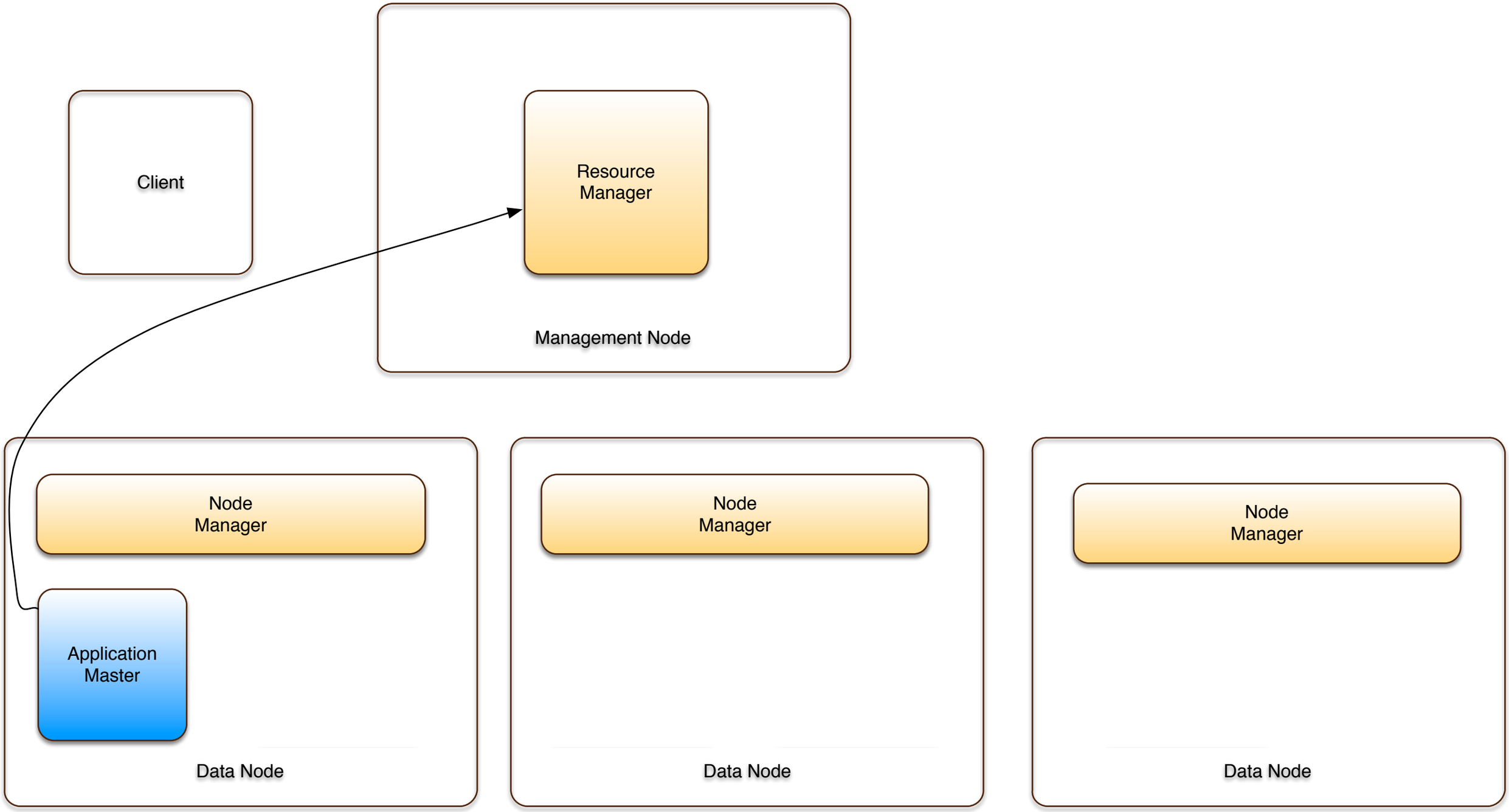
(queue, resource requirements, files, security tokens etc.)



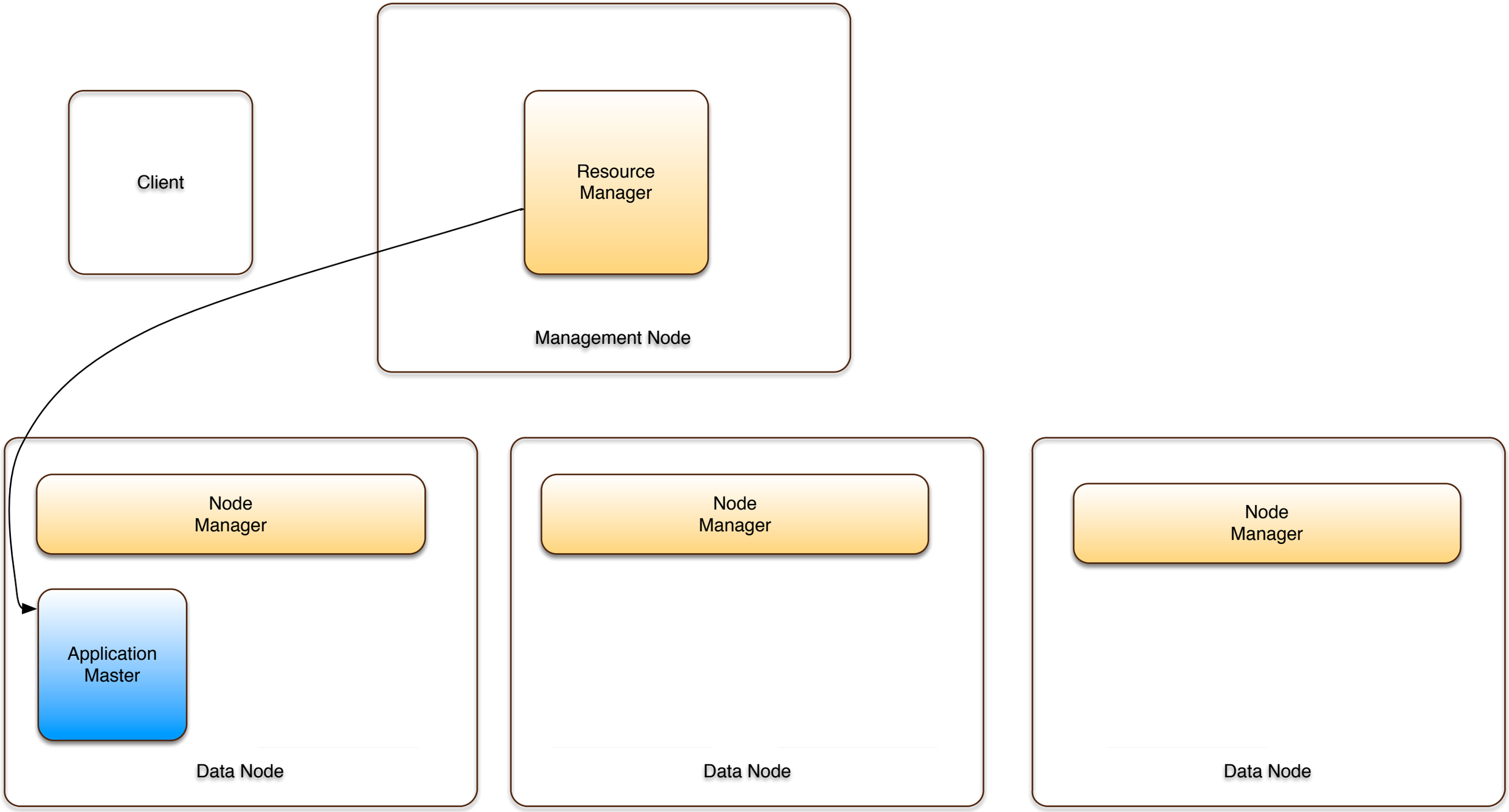
4. RM asks Node Manager to launch Application Master



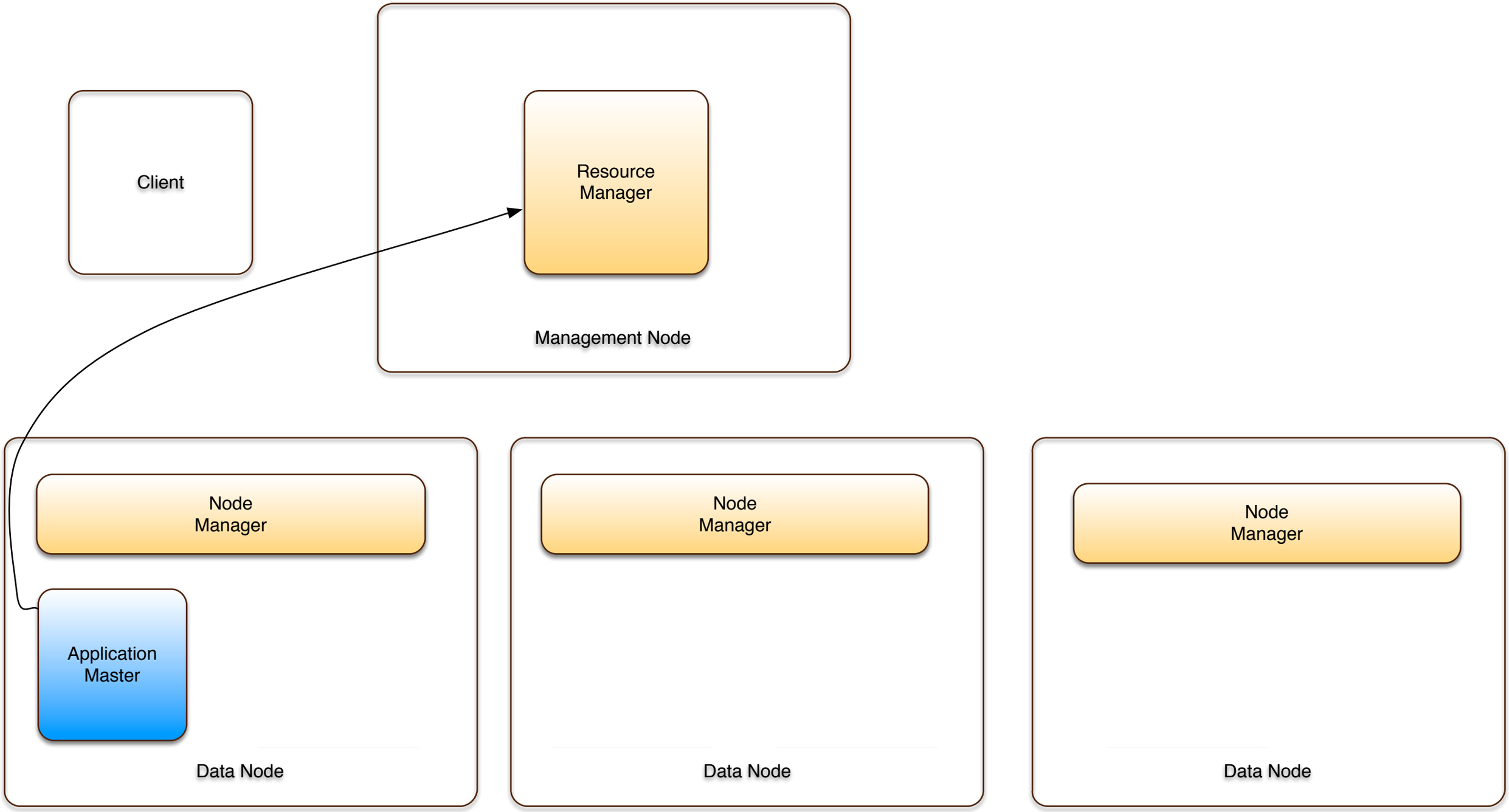
5. Node Manager launches Application Master



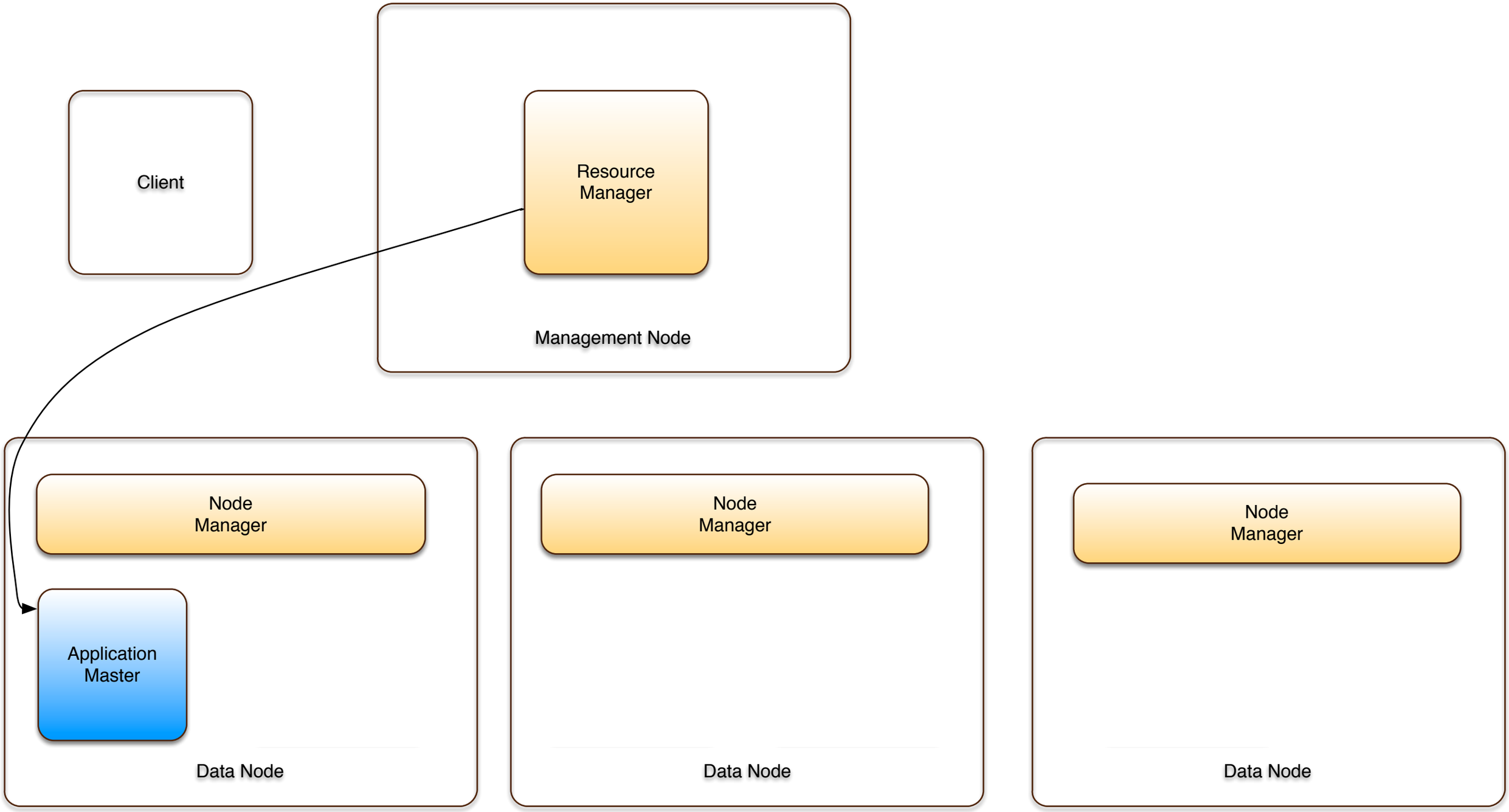
6. Application Master registers with RM



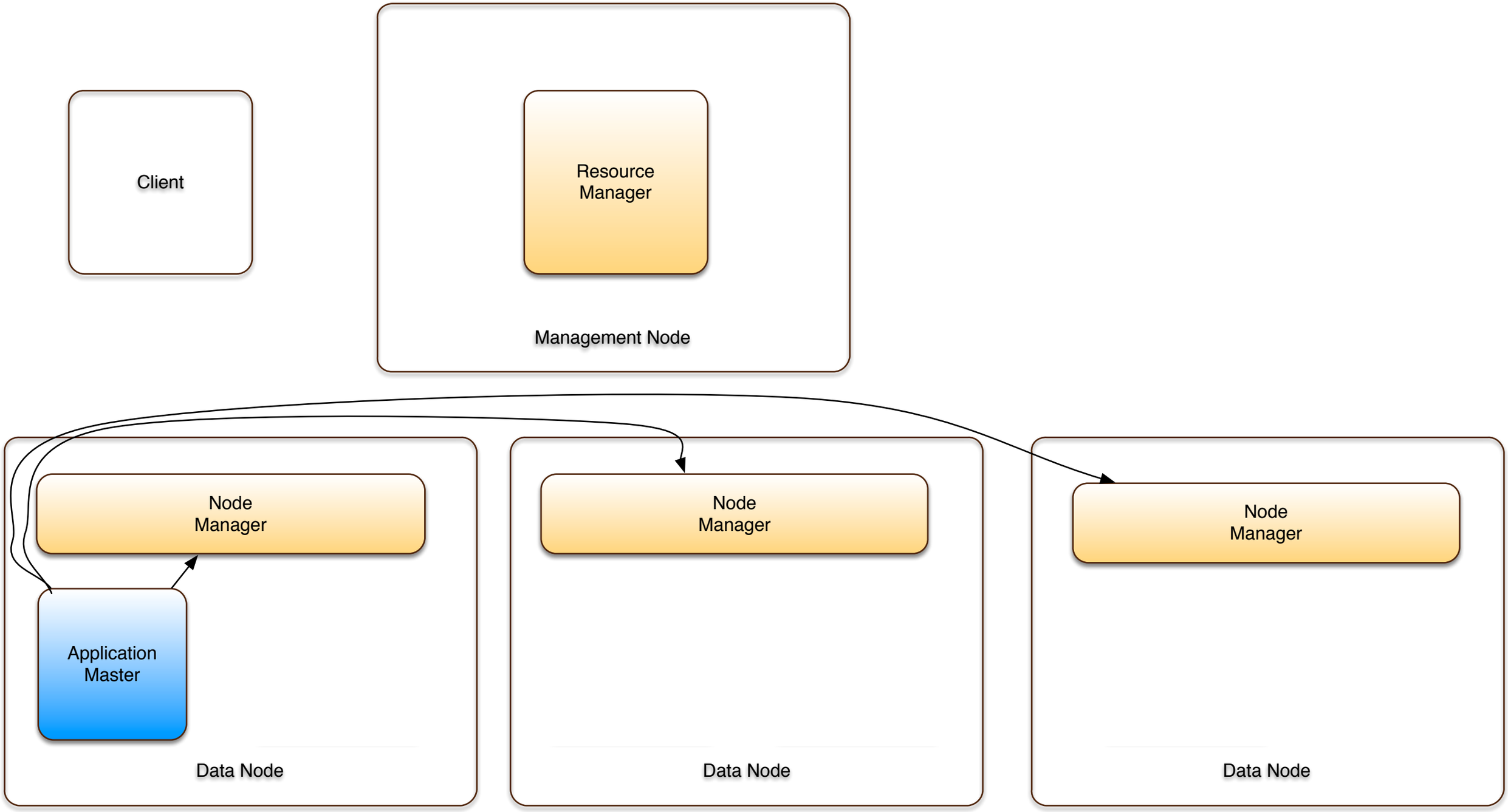
7. RM shares resource capabilities with Application Master



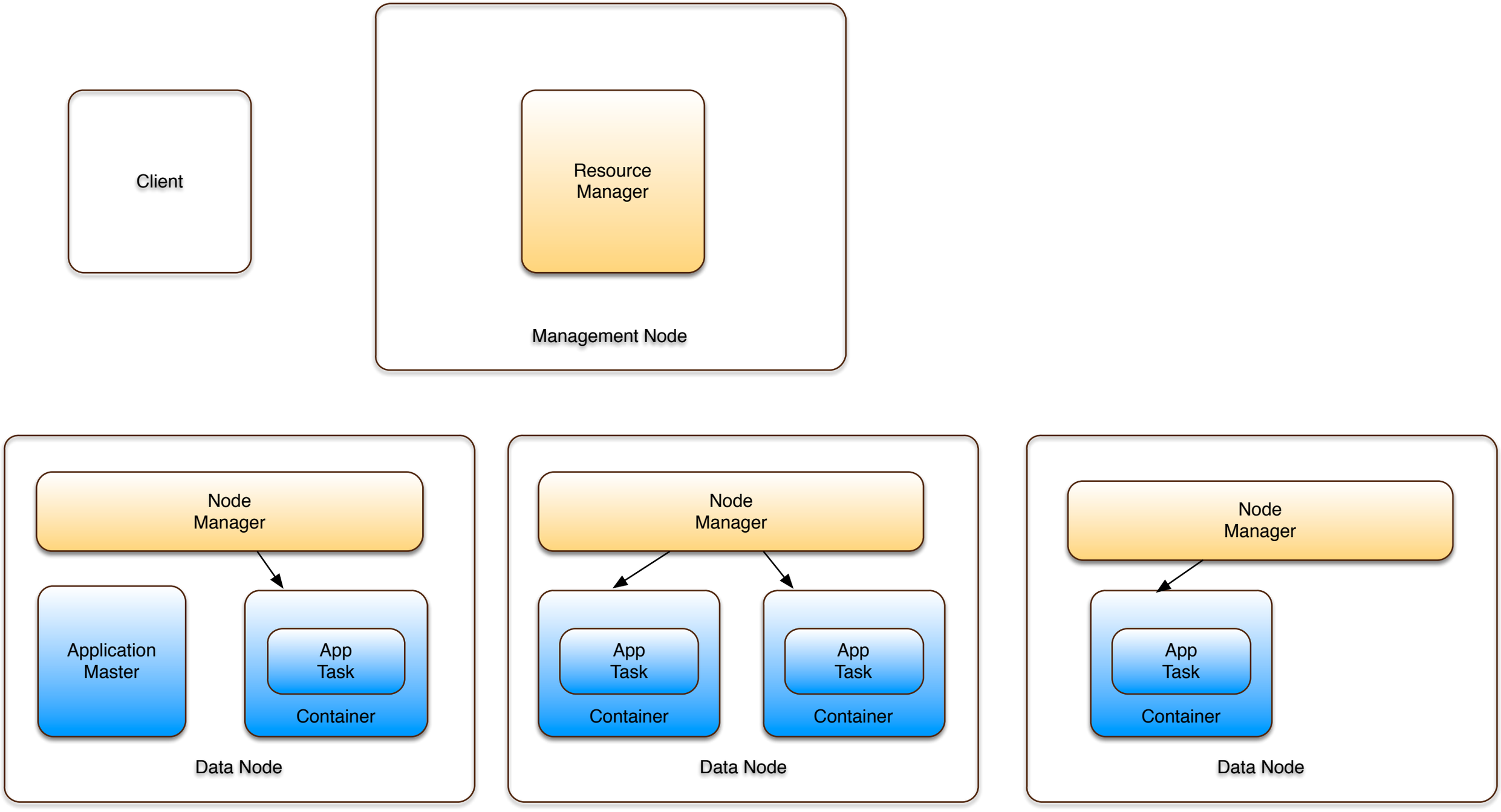
8. Application Master requests containers



9. RM assigns containers based on policies and available resources



10. Application Master contacts assigned node mageres to instantiate containers (passing container contexts)



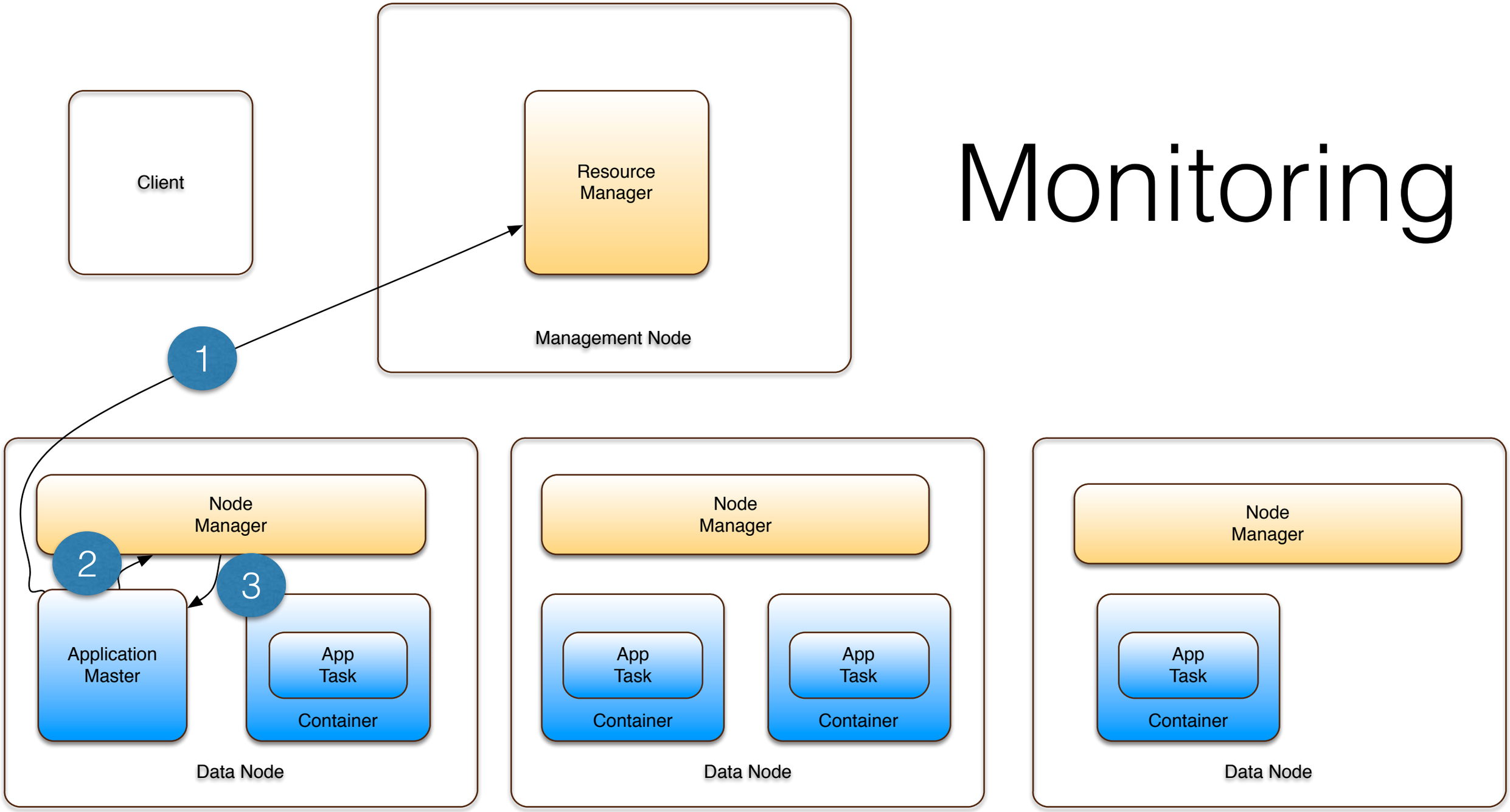
11. Node Manager initiate container(s)


Congratulations your
Application is now
running

Application Progress

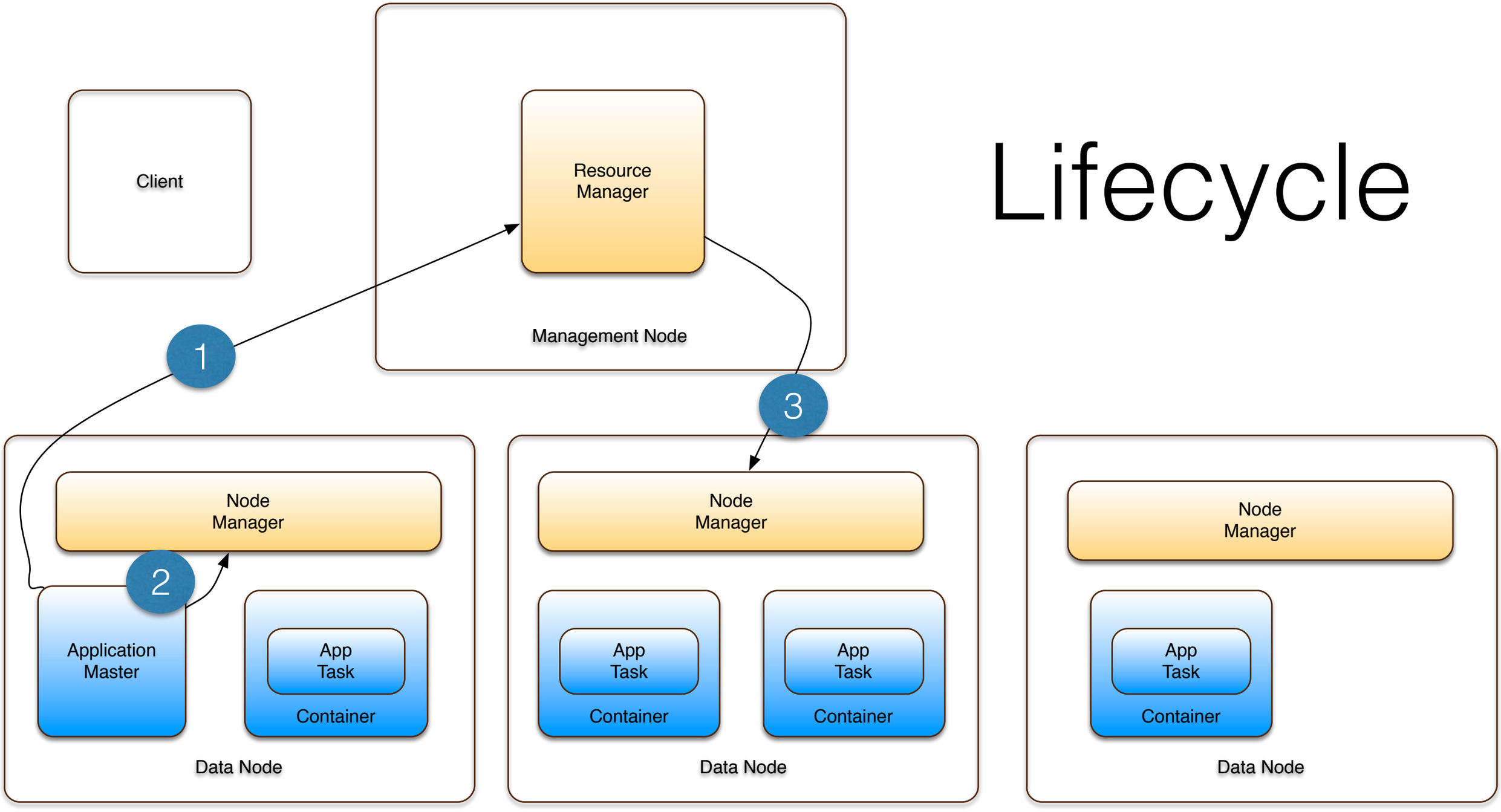
(or “it doesn’t end there”)

Monitoring



1. continuous heartbeat & progress report
2. Request container status
3. Status response

Lifecycle



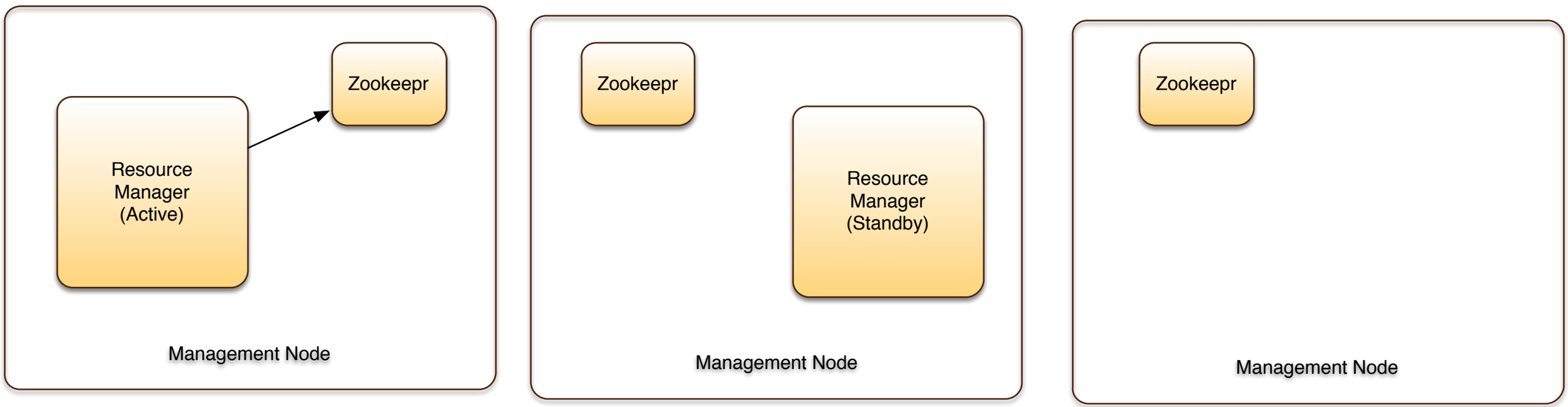
1. Heartbeat also carries request for new container allocations / container releases
2. Application master connects to node manger to activate allocated containers
3. Container releases go through the Resource Manager

YARN HA

(or “you really didn’t think that was all, did ya?”)

Still a work in progress

- Resource Manager - YARN 149 (patch available)
- Application Manager - YARN 1489
- Node Manager - YARN 1336



Active/Standby

Store state in ZooKeeper

Use ZooKeeper for failover management

YARN Limitation:
Manages memory & CPU
but not Disk IO or Network

YARN Limitations: Batch Focus

Small Batch **Large Batch**

Black Legion

YARN Limitation :

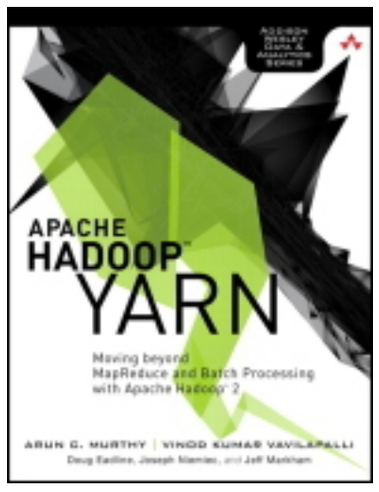
Not daemon friendly

Daemon Prince

YARN Limitation: Relatively complex to develop for

Further Reading

YARN Source code https://github.com/apache/hadoop-common/tree/trunk/hadoop-yarn-project/hadoop-yarn



Apache Hadoop YARN: Moving beyond MapReduce and Batch Processing with Hadoop 2 by Arun C. Murthy, Vinod Kumar Vavilapalli, Doug Eadline, Joseph Niemiec & Jeff Markham

Apache YARN site http://hadoop.apache.org/docs/r2.3.0/hadoop-yarn/hadoop-yarn-site/YARN.html

Image attributions:

slide 1 - Hadoop logo - http://hadoop.apache.org/docs/current/
slide 3 - adopted from pulp fiction
slide 4-5 http://pypr.sourceforge.net/kmeans.html
slide 10 - Elizabeth Moreau http://bornlibrarian.blogspot.co.il/2011/01/christmas-knitting.html
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