DOWNTIME IS NOT AN OPTION

HOW APACHE MESOS AND DC/OS KEEPS APPS RUNNING DESPITE FAILURES AND UPDATES

MESOSPHERE

WAIT, WHO ARE YOU?

Engineer at Mesosphere

DC/OS Contributor

@philipnrmn

MESOSPHERE

RUNNING NON-TRIVIAL APPLICATIONS AT SCALE IS *REALLY* COMPLICATED

A non-trivial app might well need all the following:

- multiple app servers
- load balancing
- message queues
- HA datastores
- analytics

Bring cluster computing to non-experts: One of the most exciting things about datacenter technology is that it is increasingly being applied to "big data" problems in the sciences. With cloud computing, scientists can readily acquire the hardware to run large parallel computations; the main thing missing is the right software.

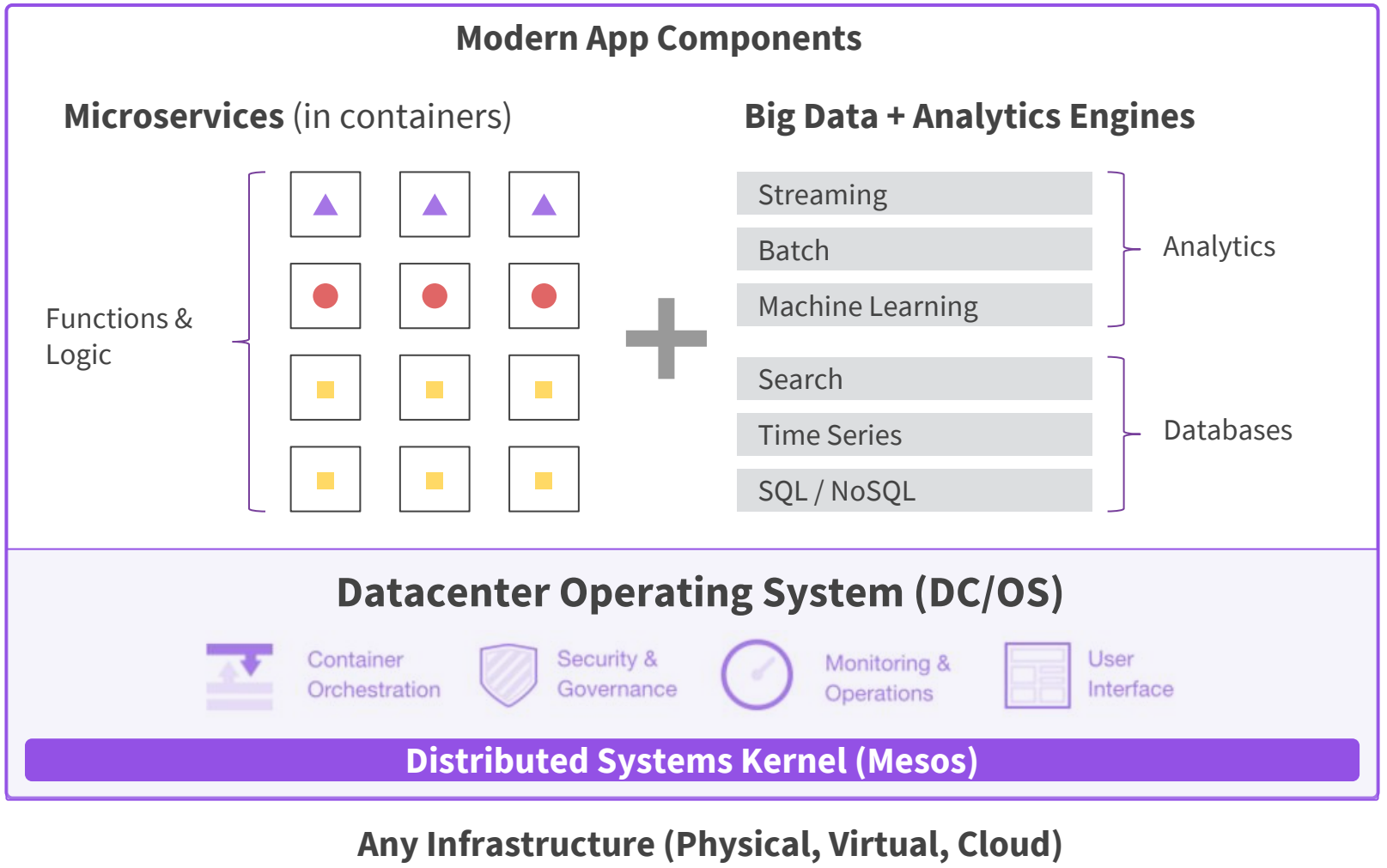
These non-expert cluster users have very different needs from those in large corporations: they are not backed by an operations team that will configure their systems and tune their programs. Instead, they need cluster software that configures itself correctly out of the box, rarely fails, and can be debugged without intimate knowledge of several interacting distributed systems. These are difficult but worthwhile challenges for the community to pursue.

-The Datacenter Needs an Operating System

APACHE MESOS IS A CLUSTER RESOURCE MANAGER

DC/OS

DC/OS ENABLES MODERN DISTRIBUTED APPS



APACHE MESOS

THE KERNEL OF THE DC/OS

APACHE MESOS

THE BIRTH OF MESOS

Spring 2009

CS262B

Ben Hindman, Andy Konwinski and Matei Zaharia create “Nexus” as their CS262B class project.

March 2010

TWITTER TECH TALK

The grad students working on Mesos give a tech talk at Twitter.

September 2010

MESOS PUBLISHED

Mesos: A Platform for Fine-Grained Resource Sharing in the Data Center is published as a technical report.

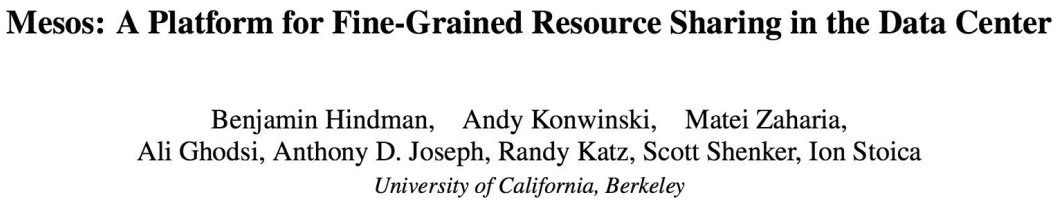
December 2010

APACHE INCUBATION

Mesos enters the Apache Incubator.

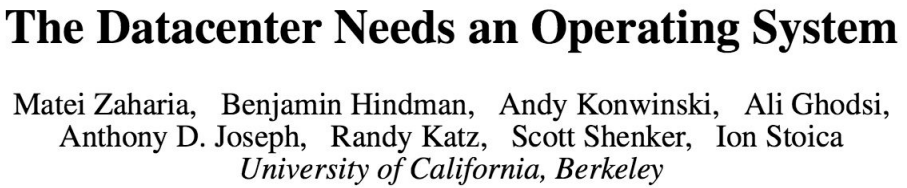
APACHE MESOS

GRAD STUDENTS LEARNED HOW TO SHARE



Mesos: A Platform for Fine-Grained Resource Sharing in the Data Center

Benjamin Hindman, Andy Konwinski, Matei Zaharia,
Ali Ghodsi, Anthony D. Joseph, Randy Katz, Scott Shenker, Ion Stoica
University of California, Berkeley



The Datacenter Needs an Operating System

Matei Zaharia, Benjamin Hindman, Andy Konwinski, Ali Ghodsi,
Anthony D. Joseph, Randy Katz, Scott Shenker, Ion Stoica
University of California, Berkeley

Sharing resources between batch processing frameworks:

- Hadoop
- MPI
- Spark

What does an operating system provide?

- Resource management
- Programming abstractions
- Security
- Monitoring, debugging, logging

CLUSTERING YOUR RESOURCES FOR YOU

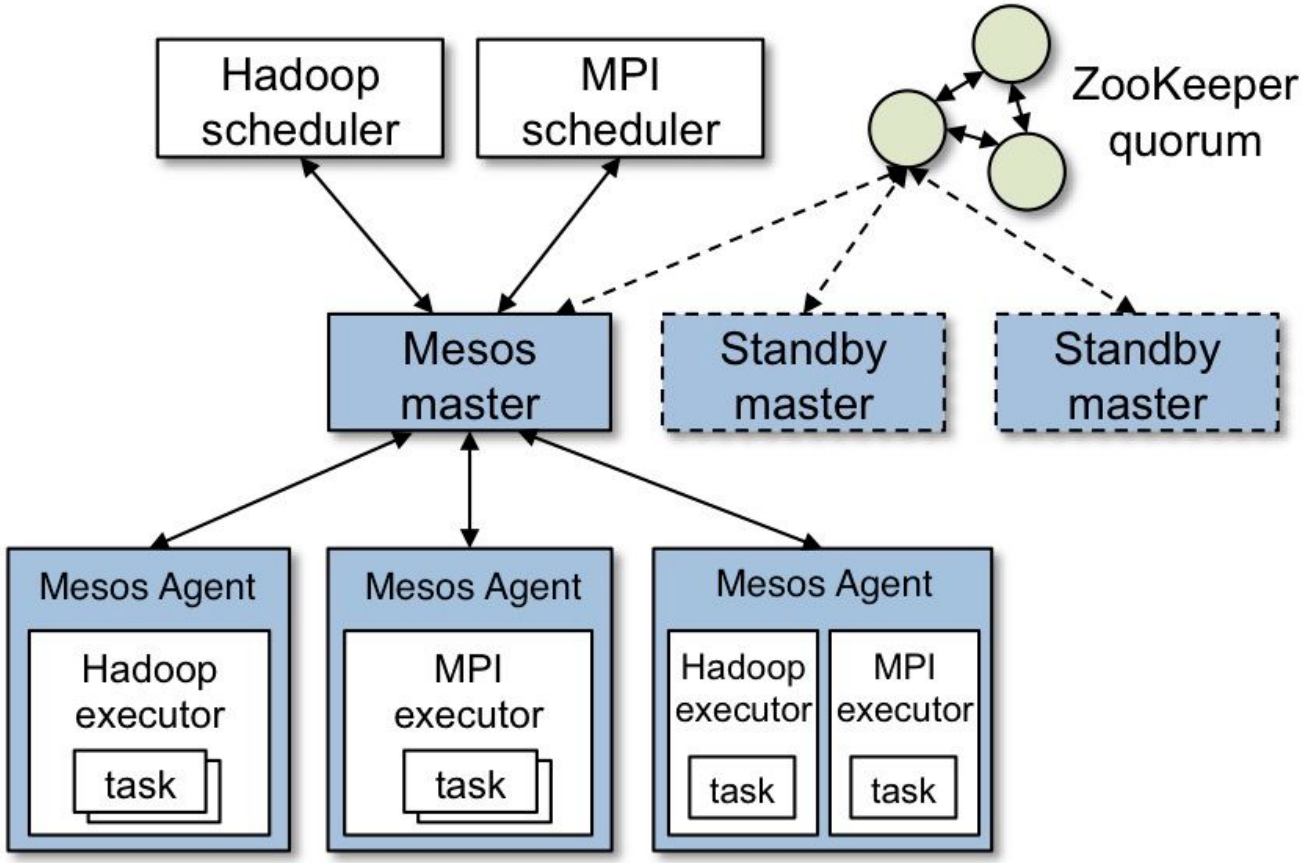
Apache Mesos is a **cluster resource manager**.

It handles:

- **Aggregating resources** and **offering them to schedulers**
- **Launching tasks** (i.e. processes) on those resources
- **Communicating the state of those tasks** back to schedulers
- Tasks can be:
  - Long running services
  - Ephemeral / batch jobs

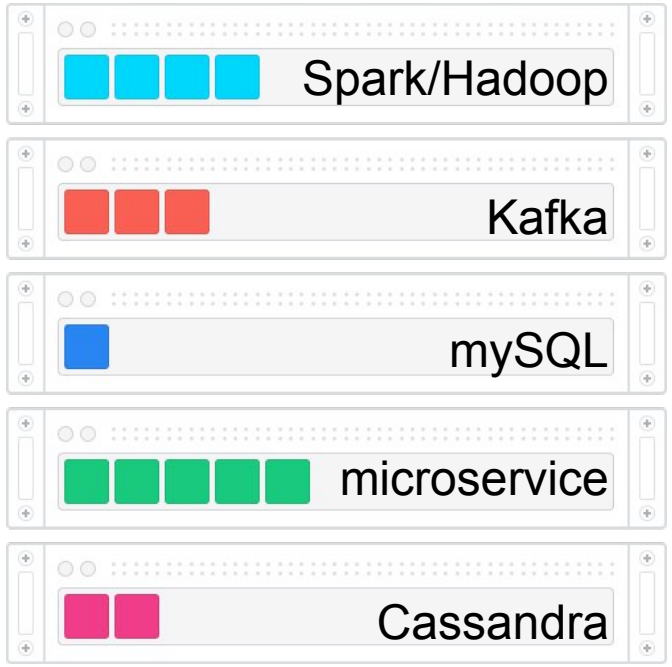
APACHE MESOS

SCHEDULERS AND TASKS



APACHE MESOS

A NAIVE APPROACH

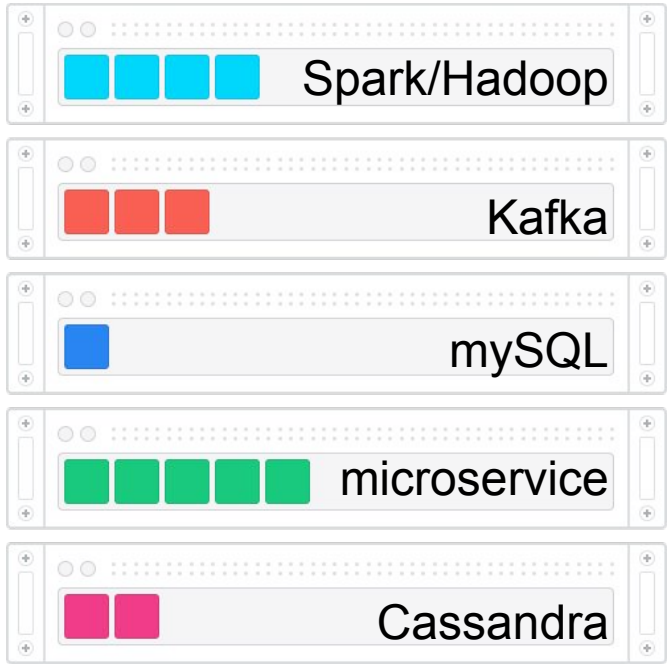


Industry Average
12-15% utilization

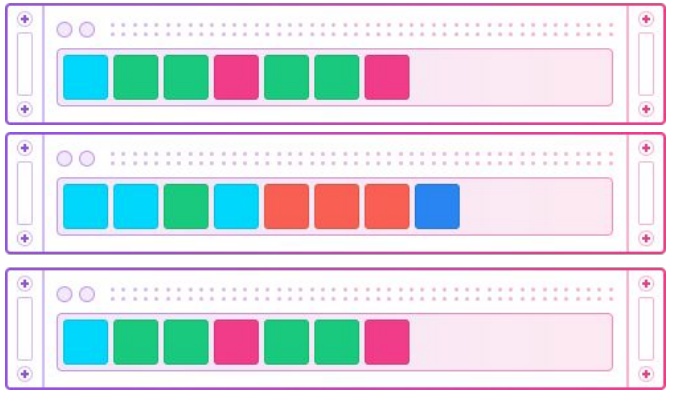
Typical Datacenter
siloed, over-provisioned servers,
low utilization

APACHE MESOS

MULTIPLEXING OF DATA, SERVICES, USERS, ENVIRONMENTS



Typical Datacenter
siloed, over-provisioned servers, low utilization



Mesos/ DC/OS
automated schedulers, workload multiplexing onto the same machines

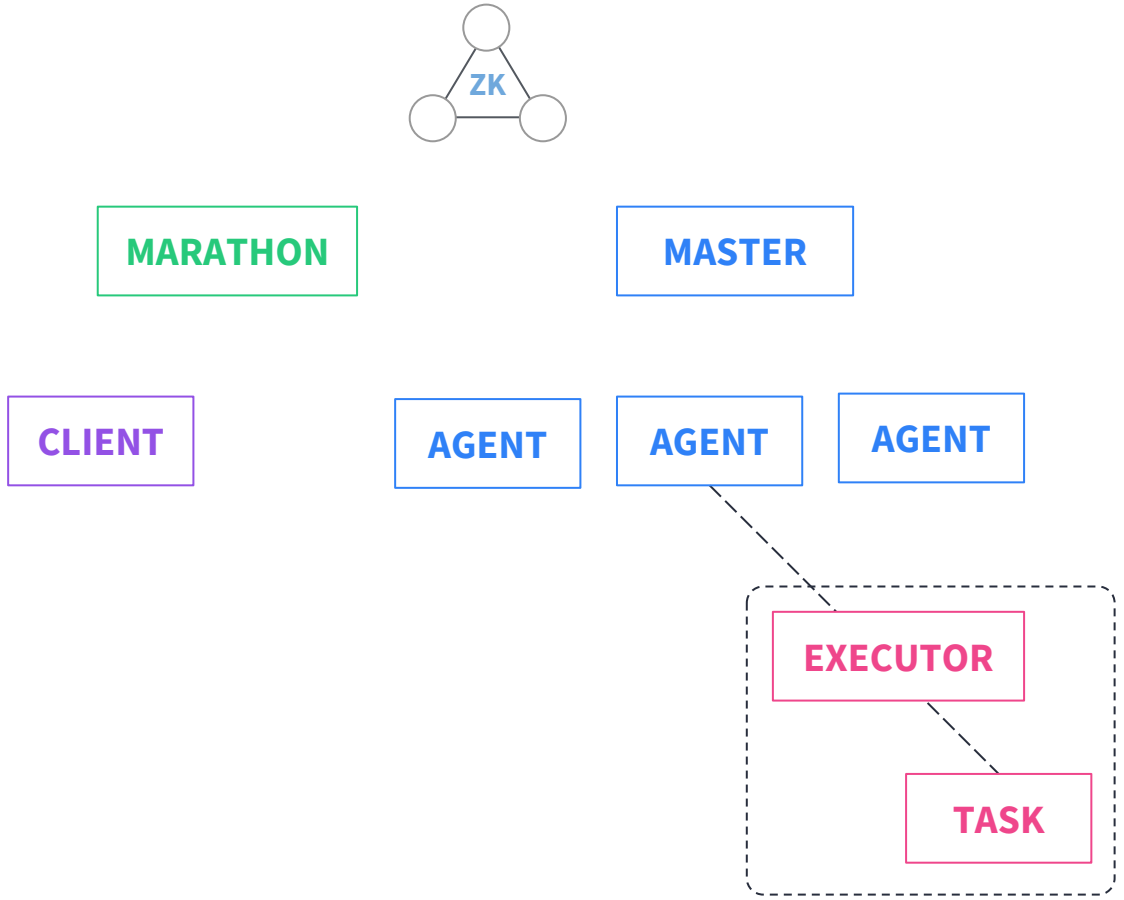
FAILURE

HANDLING FAILURE

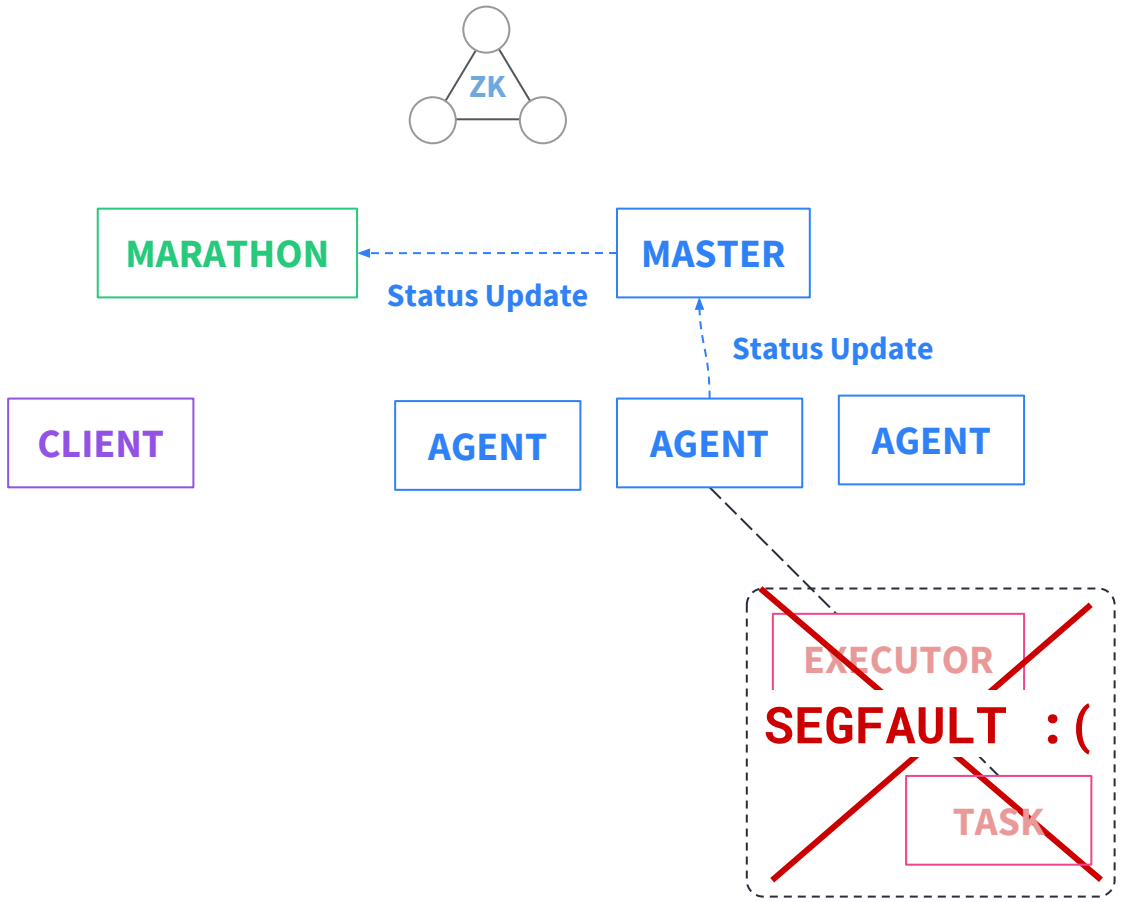
FAILURE

MESOS TASK FAILURE

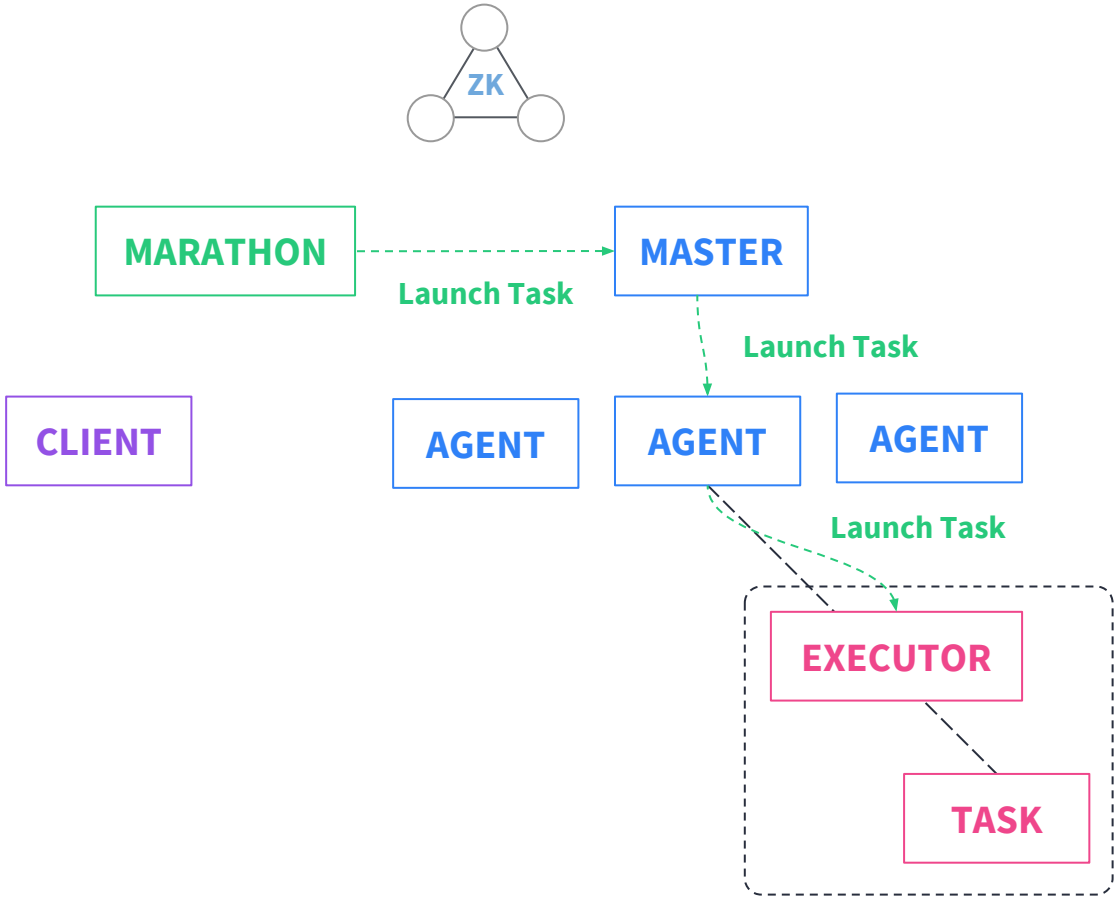
MESOS TASK FAILURE



MESOS TASK FAILURE



MESOS TASK FAILURE



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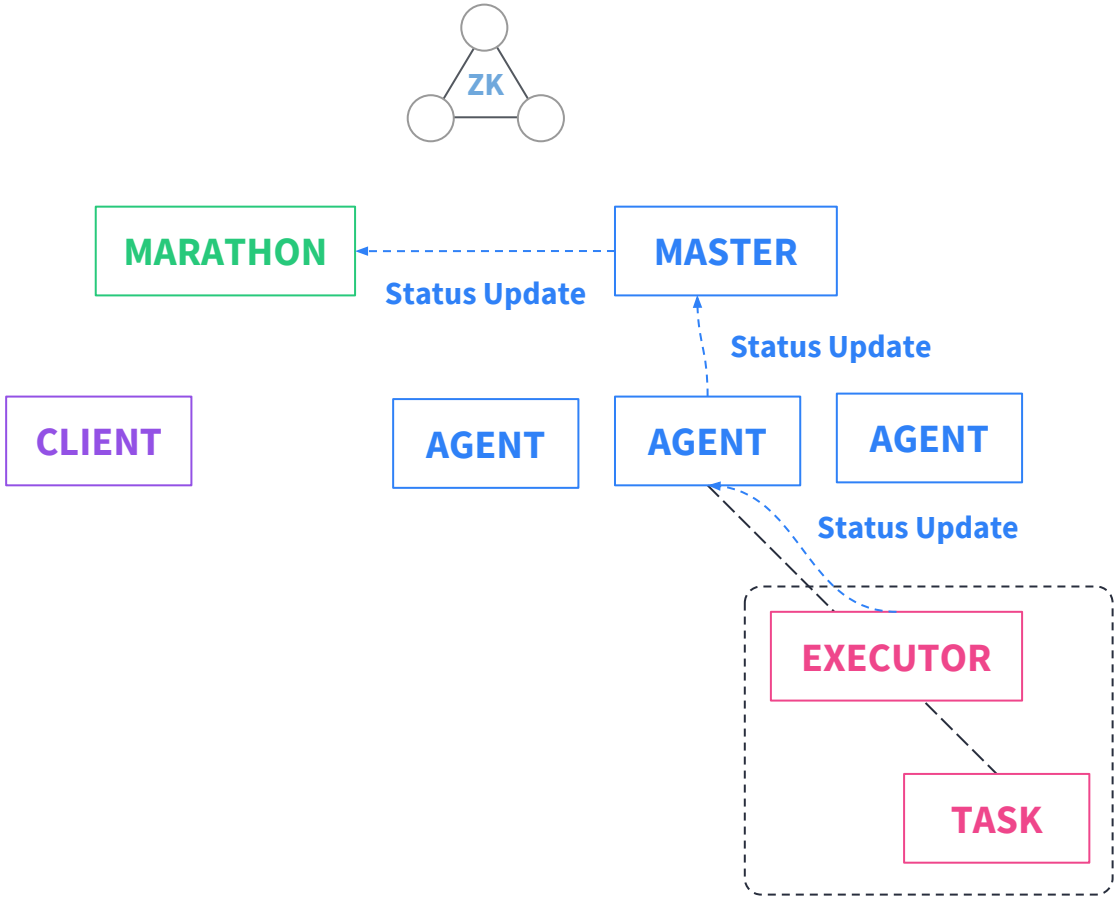
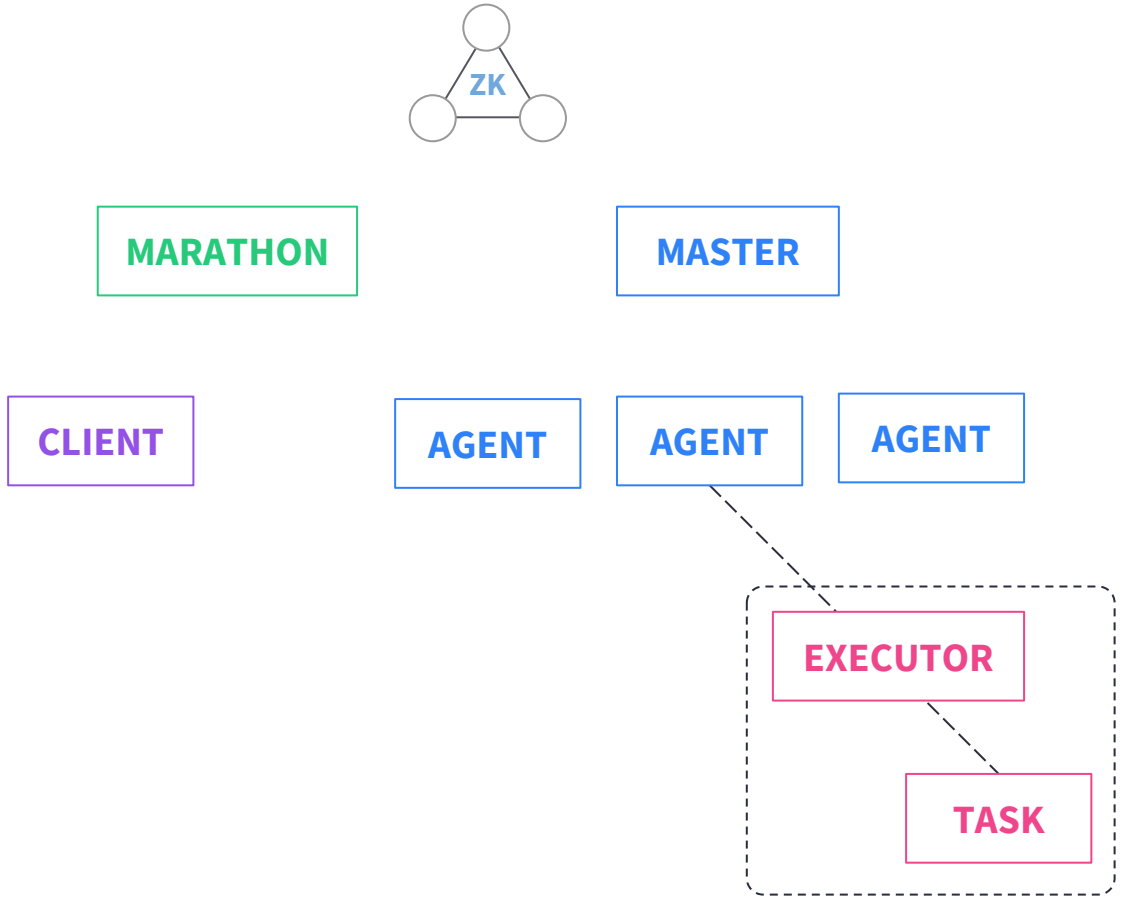


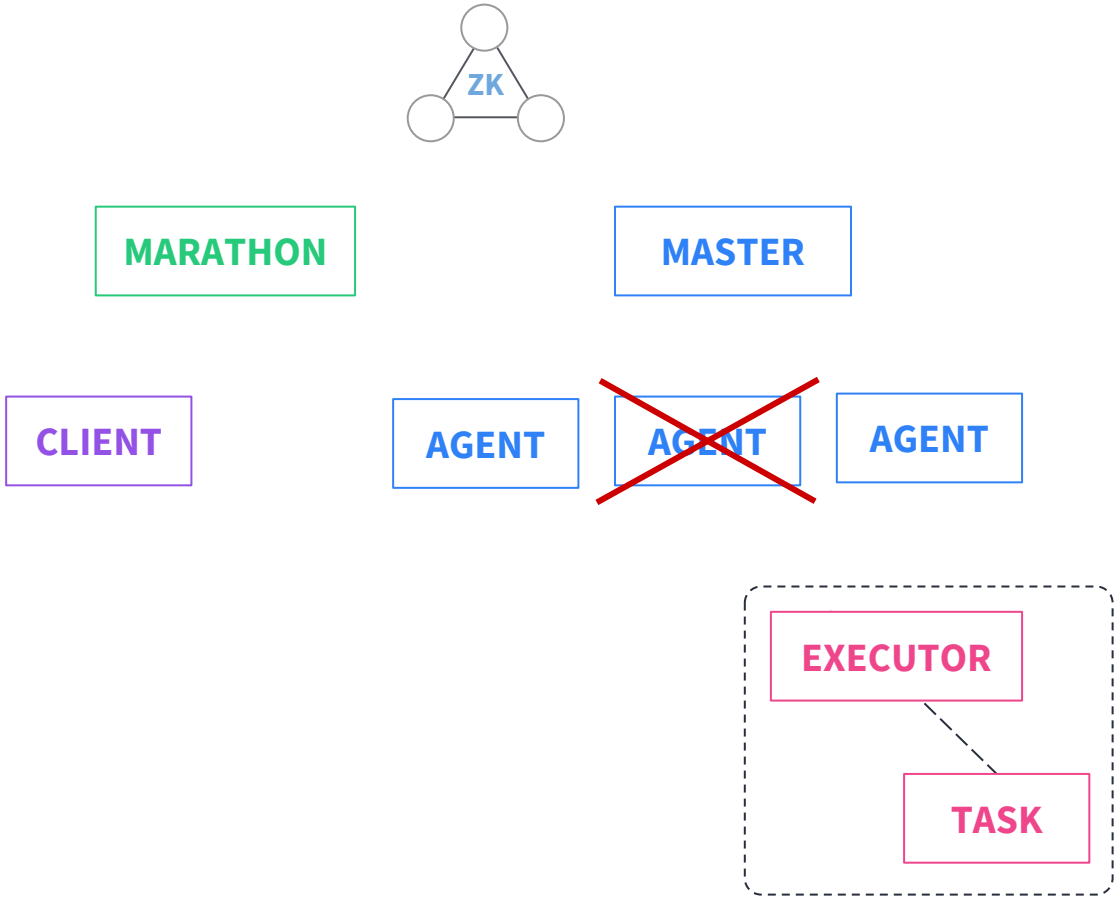
FAILURE

MESOS AGENT FAILURE

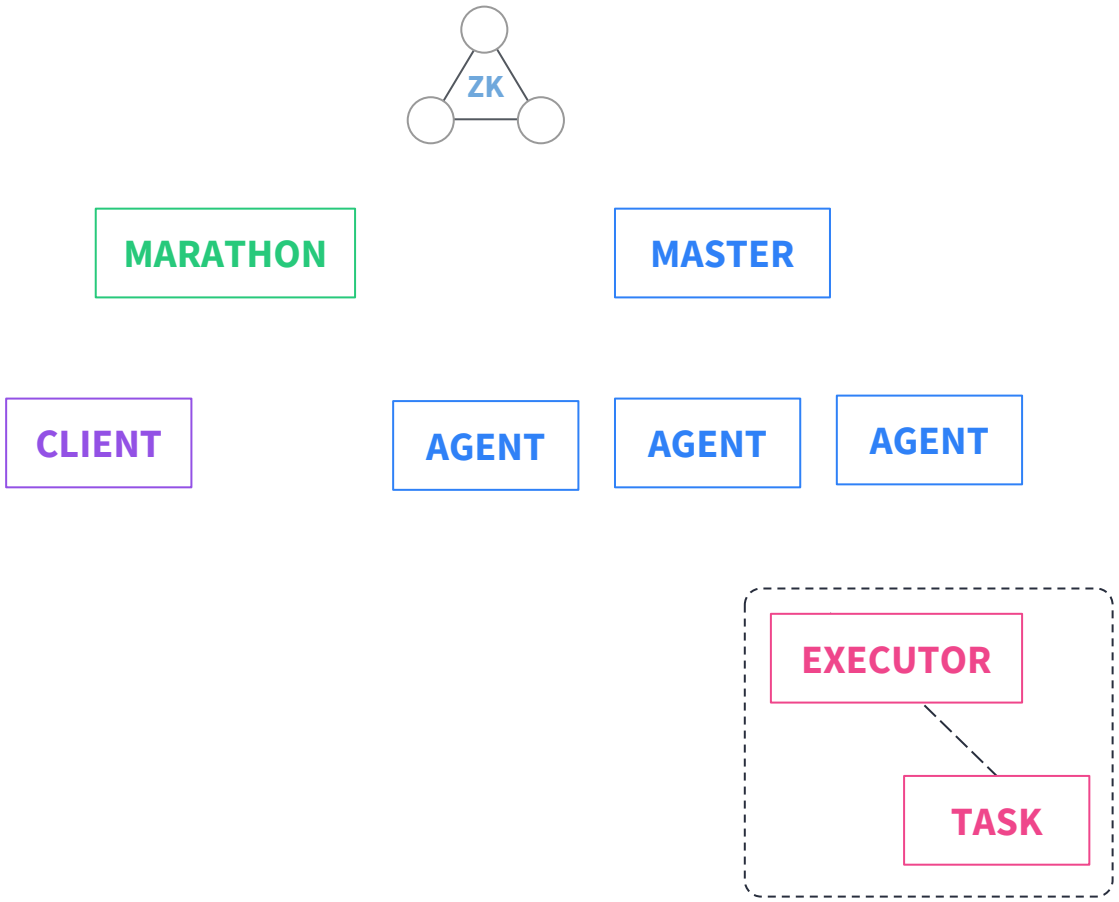
LOCAL AGENT FAILURE



LOCAL AGENT FAILURE



LOCAL AGENT FAILURE



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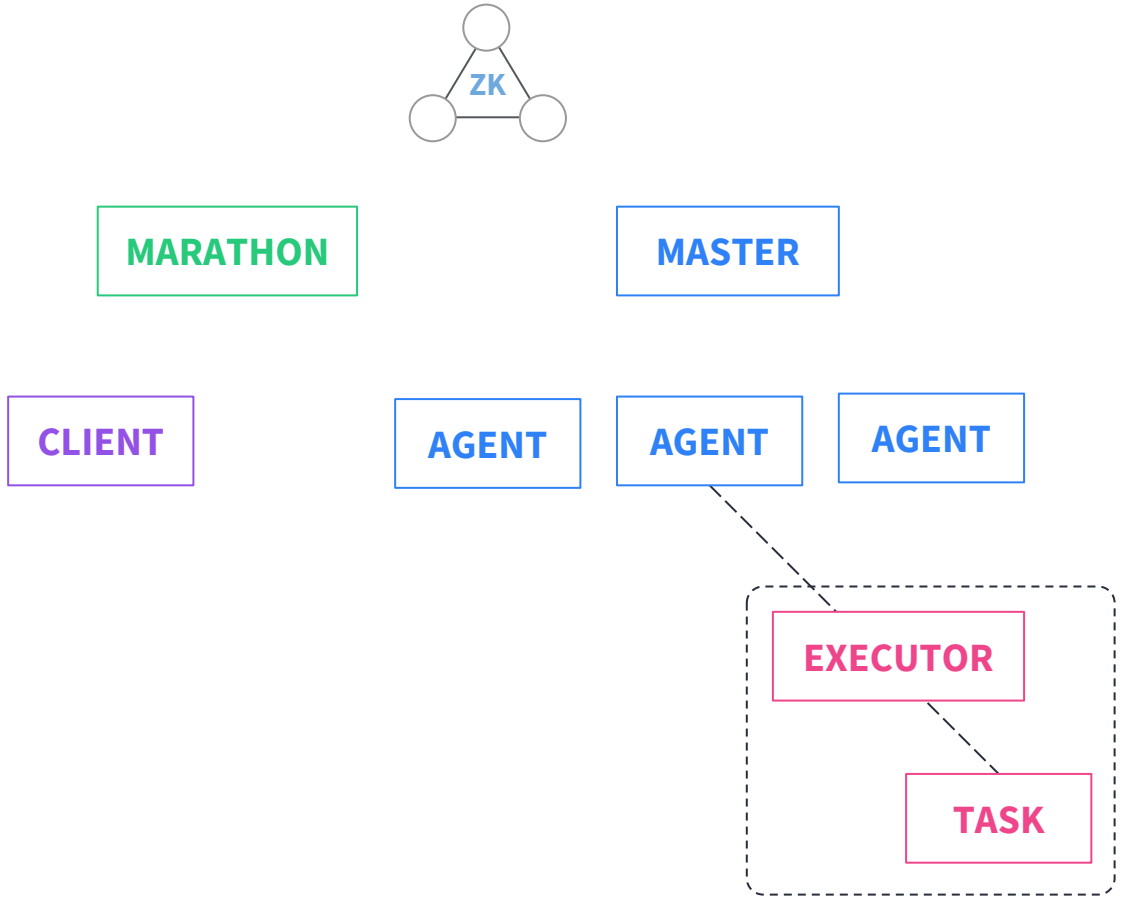

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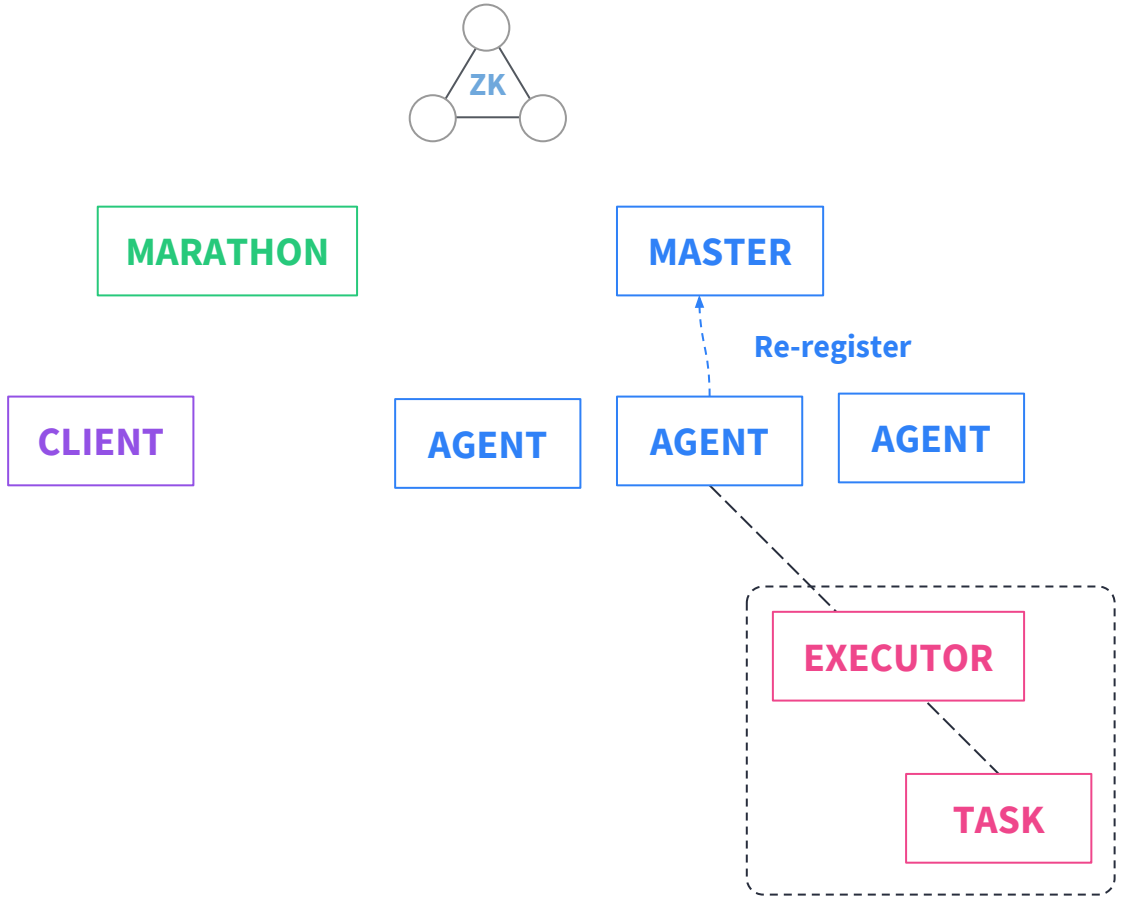
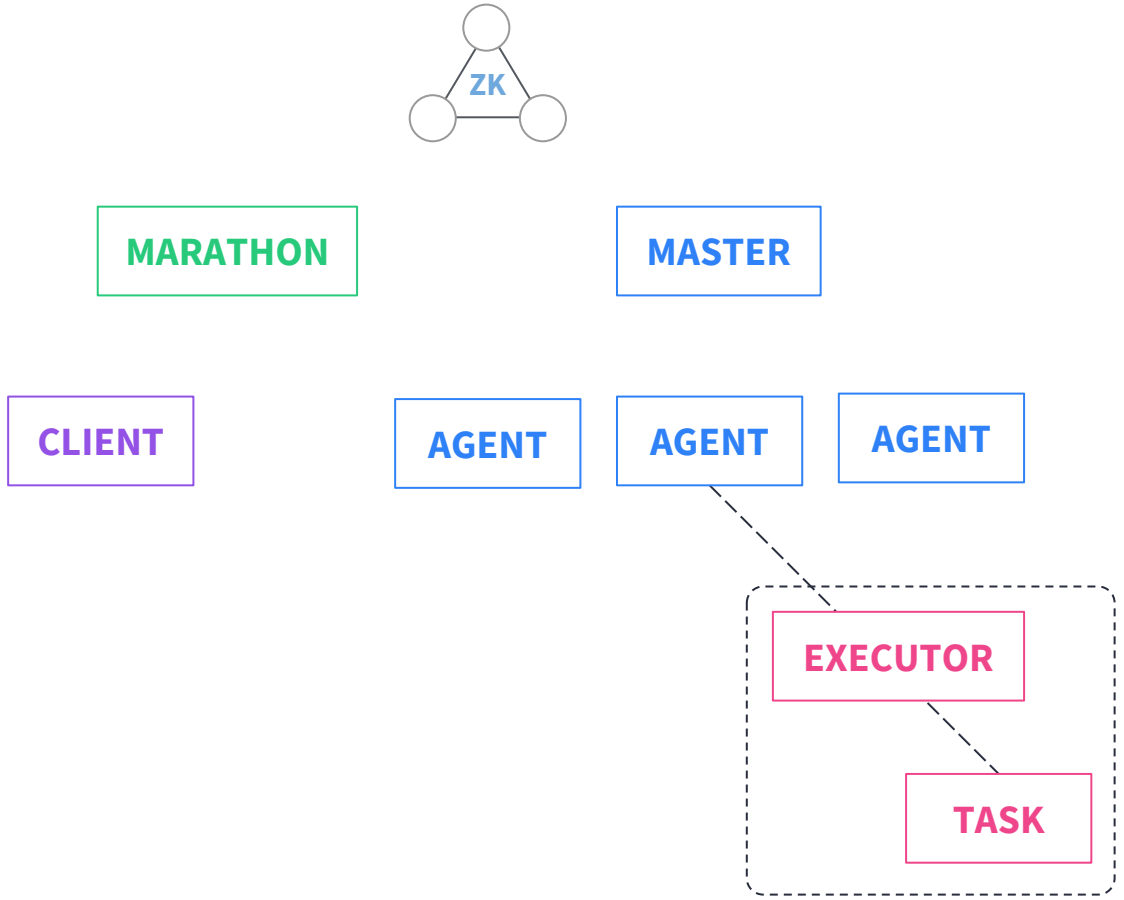


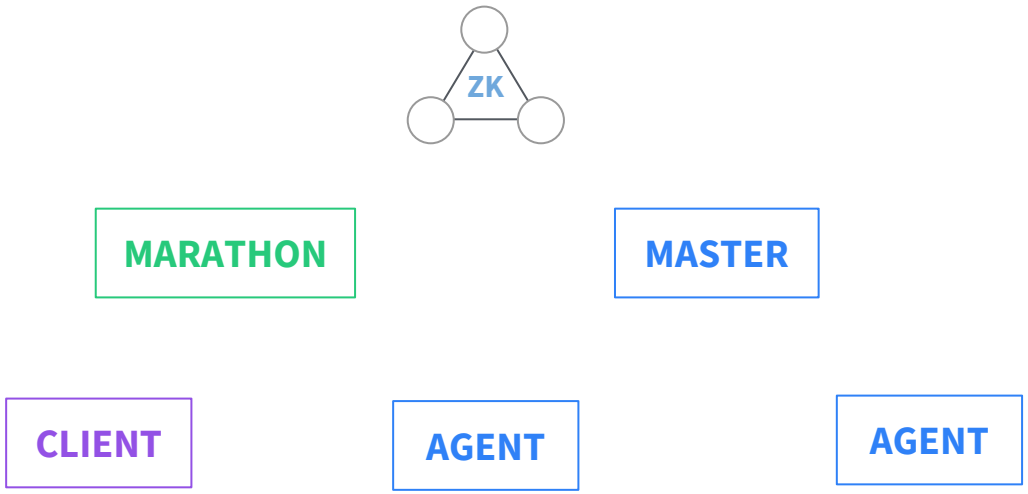
FAILURE

MESOS HOST FAILURE

LOCAL AGENT FAILURE



LOCAL AGENT FAILURE



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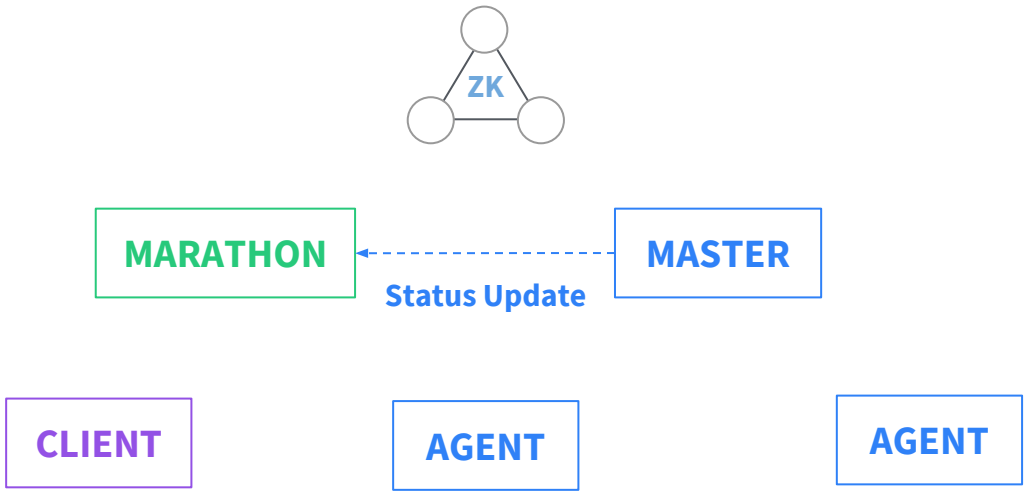
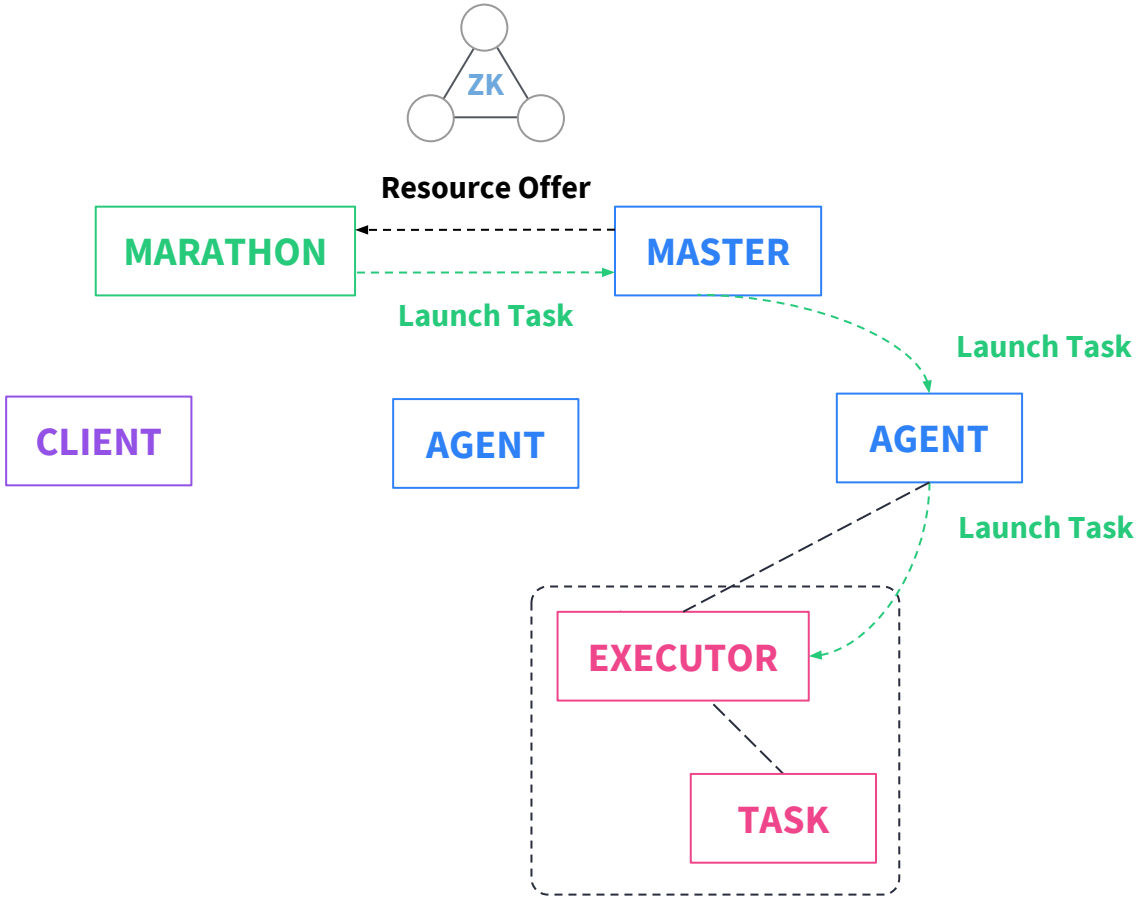
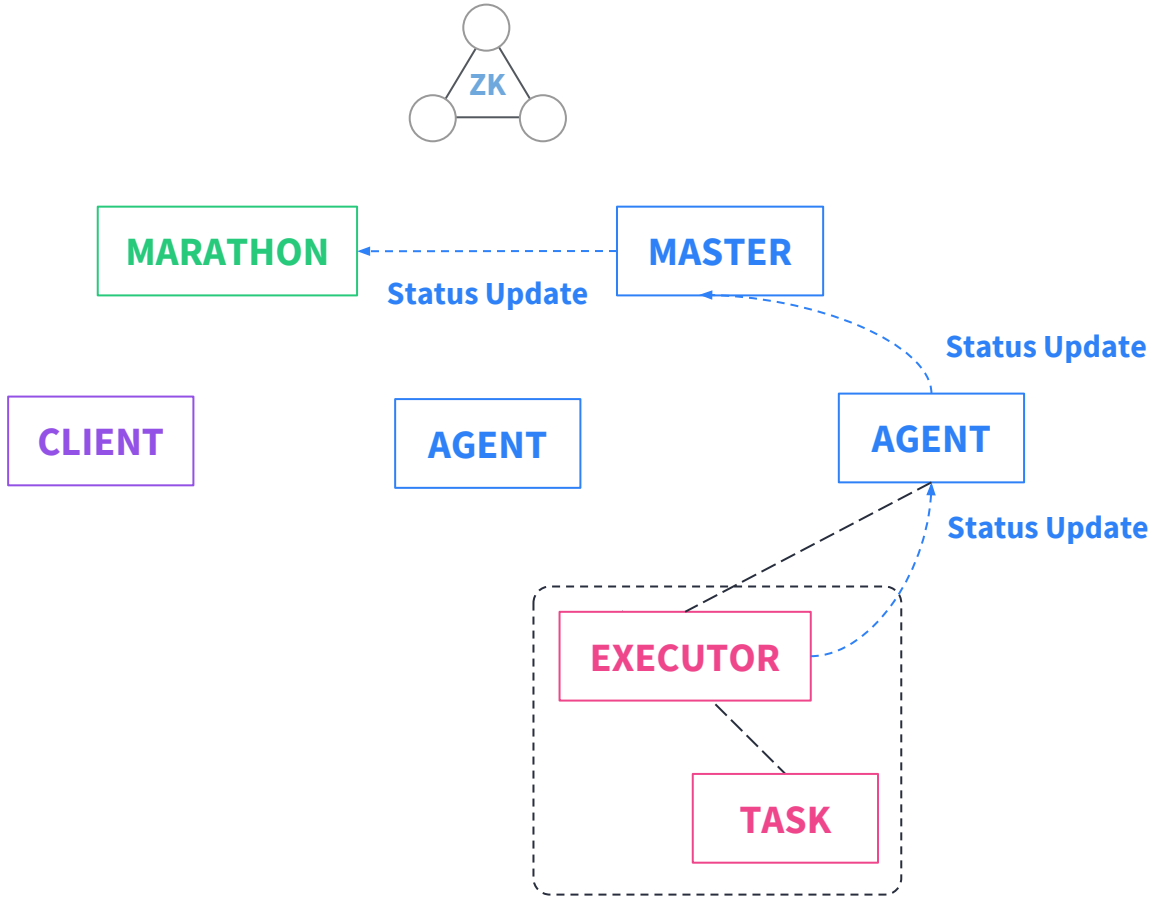


MESOS TASK FAILURE



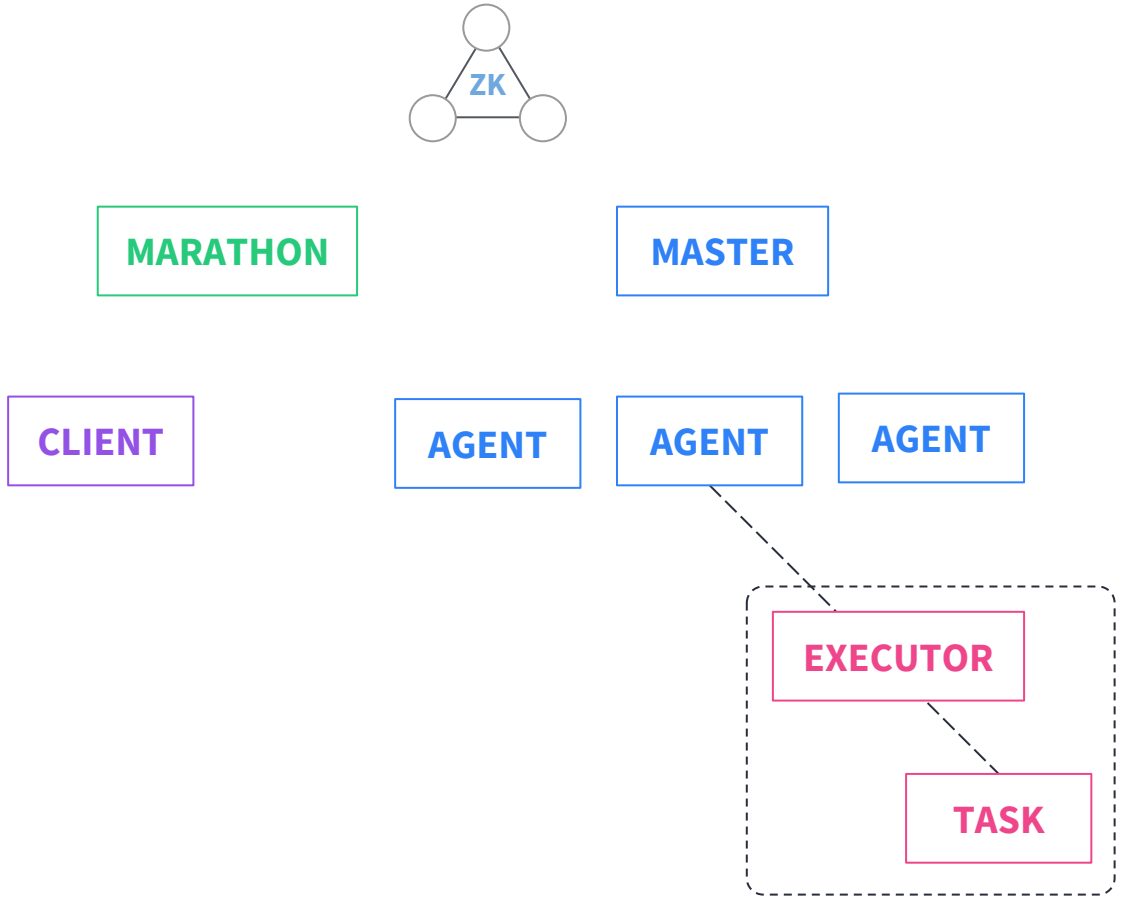
MESOS TASK FAILURE



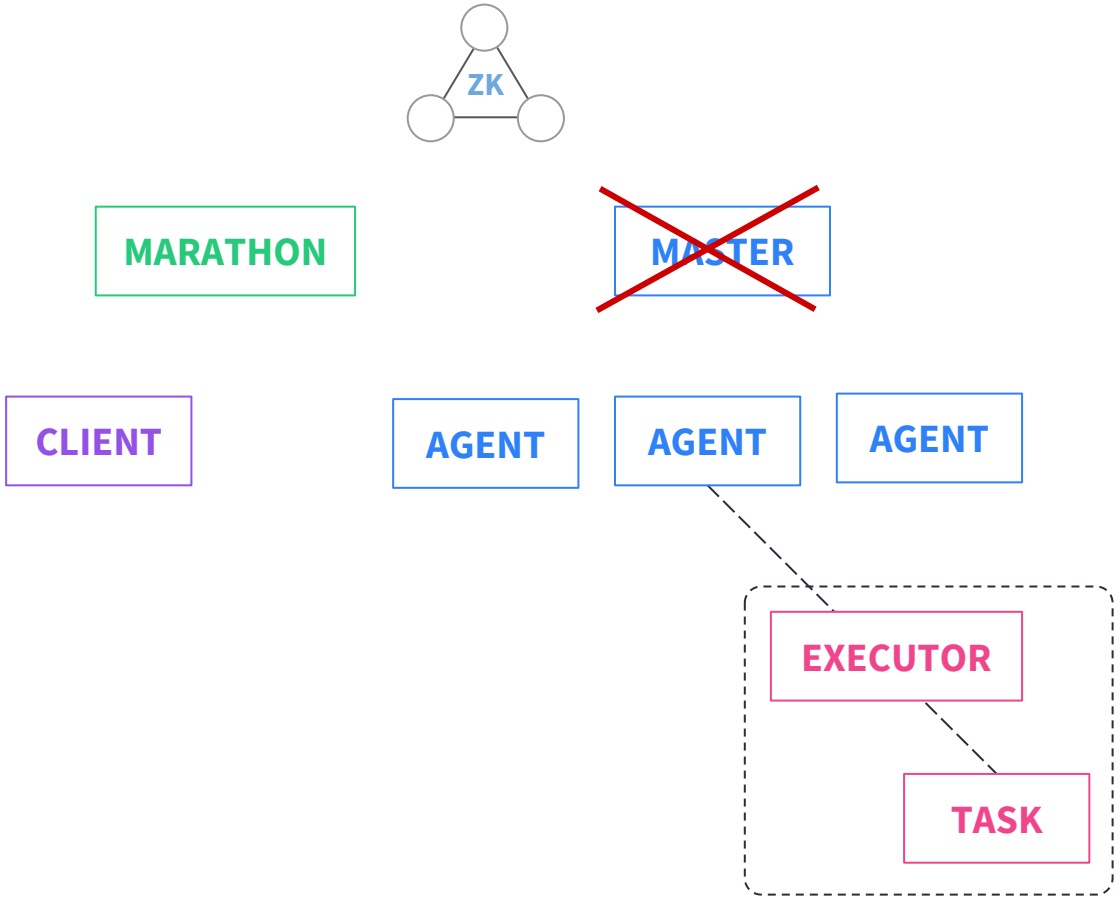
FAILURE

MESOS MASTER FAILURE

MASTER FAILURE



MASTER FAILURE



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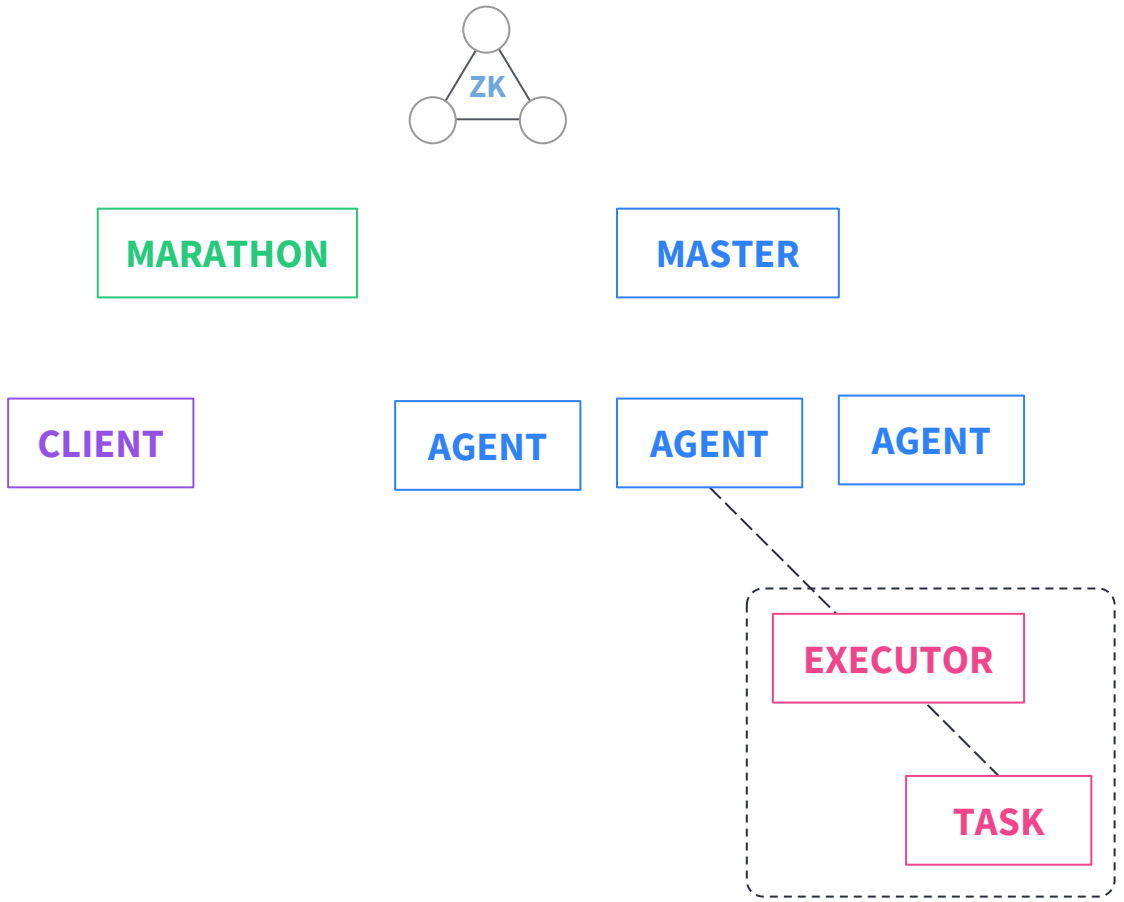

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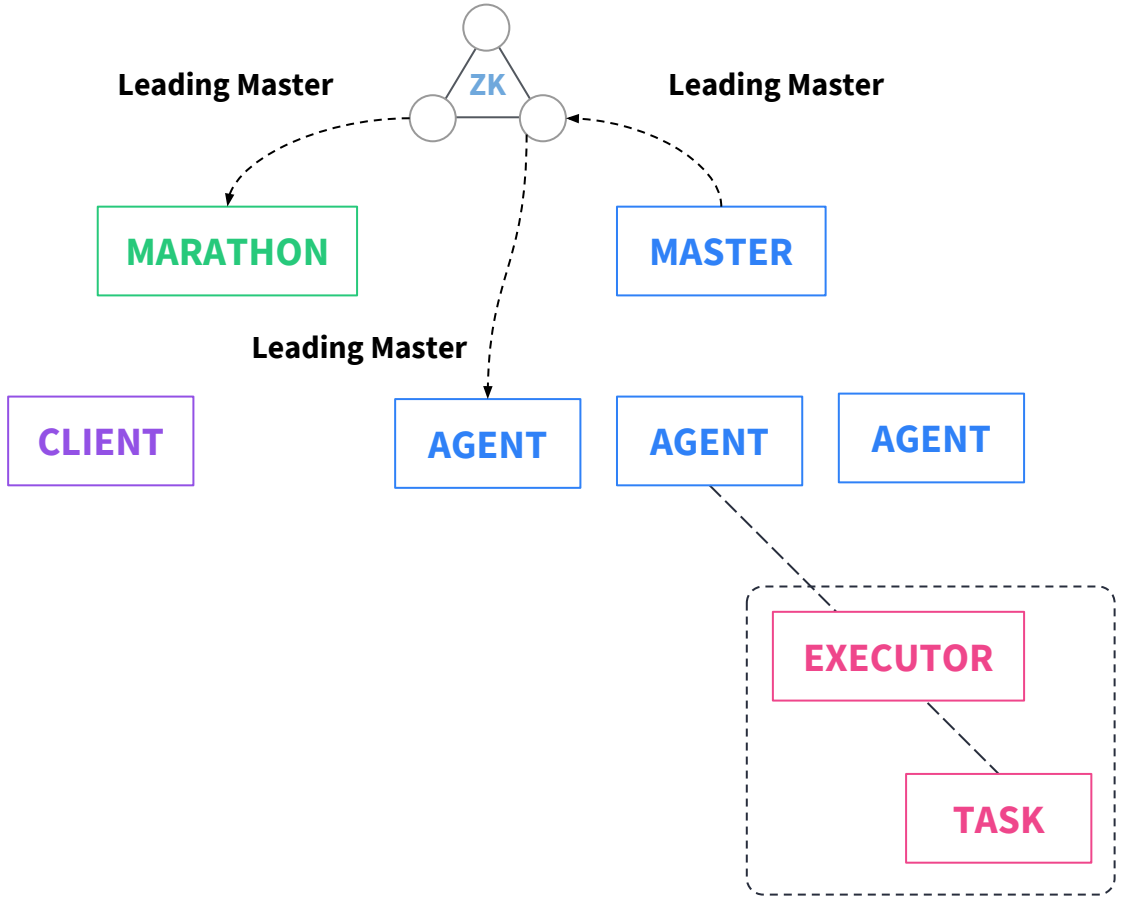

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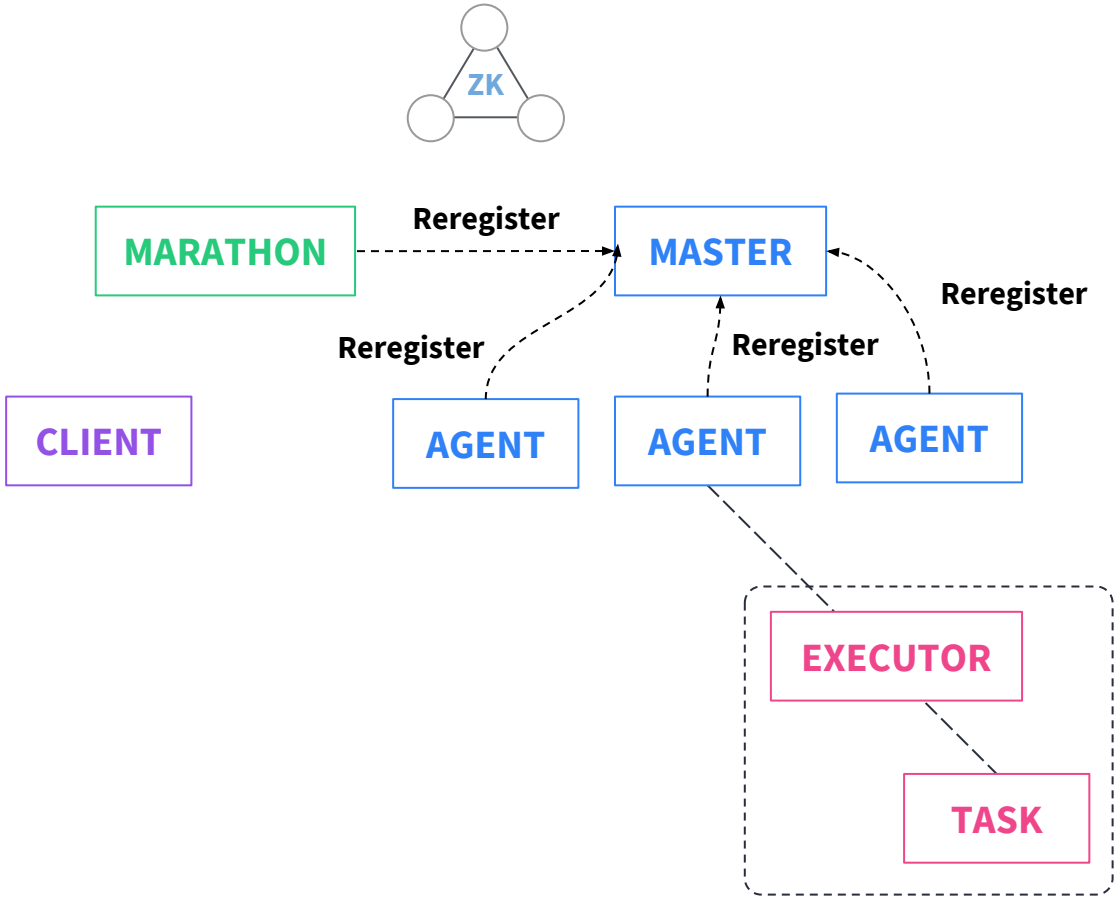

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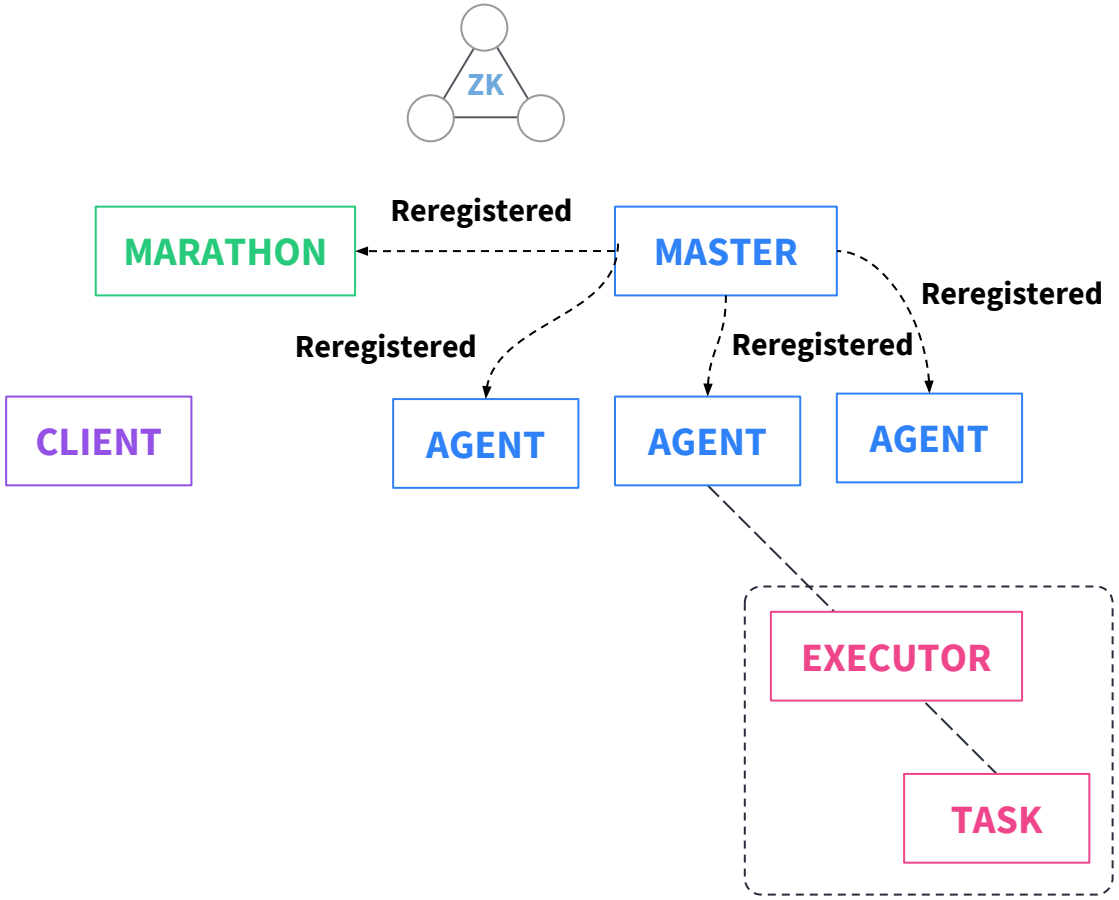
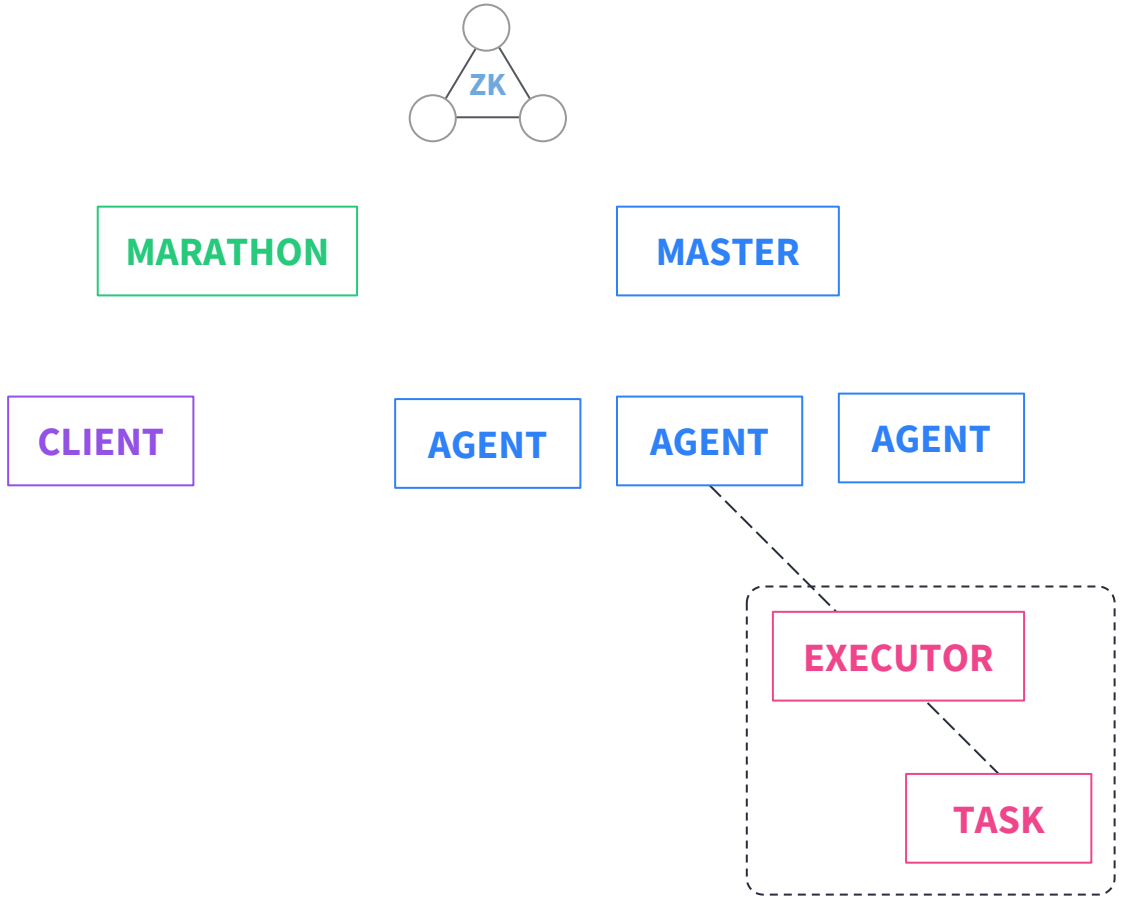


FAILURE

SCHEDULER FAILURE

SCHEDULER FAILURE



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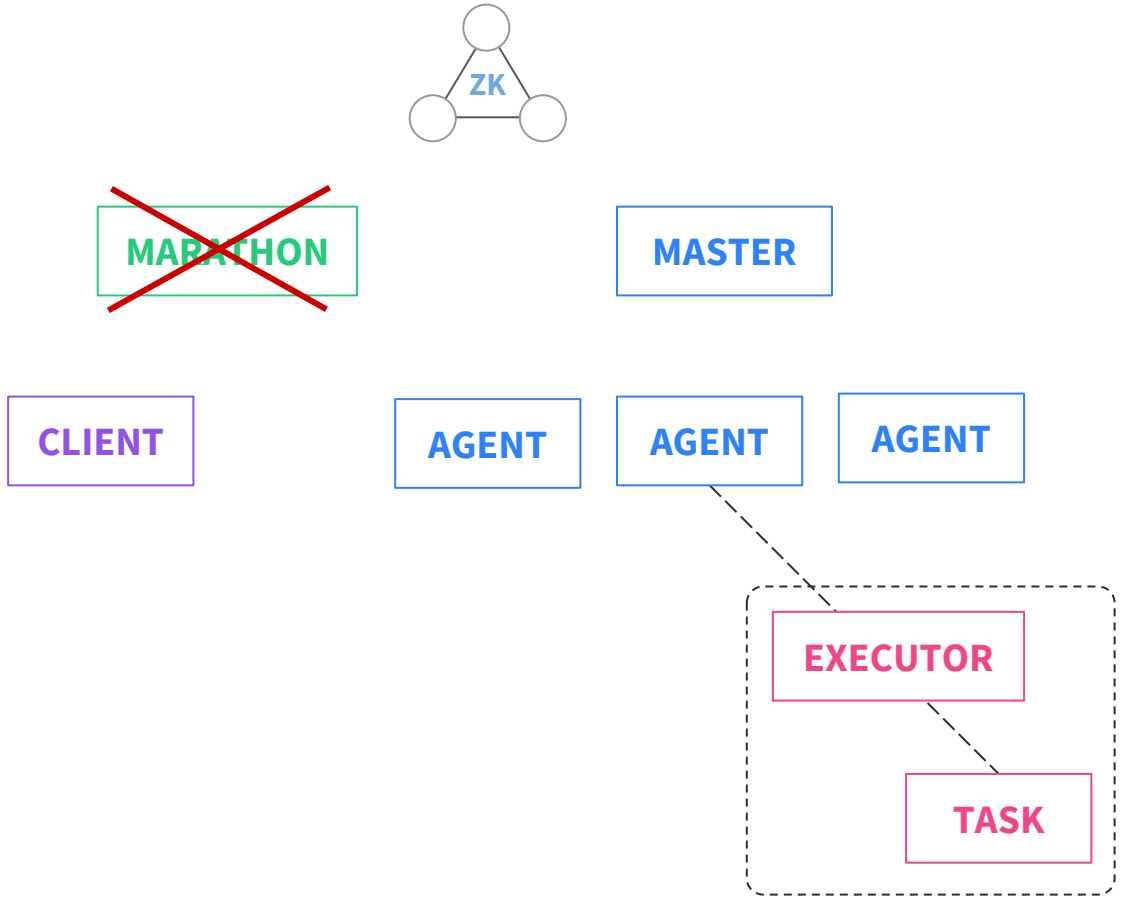

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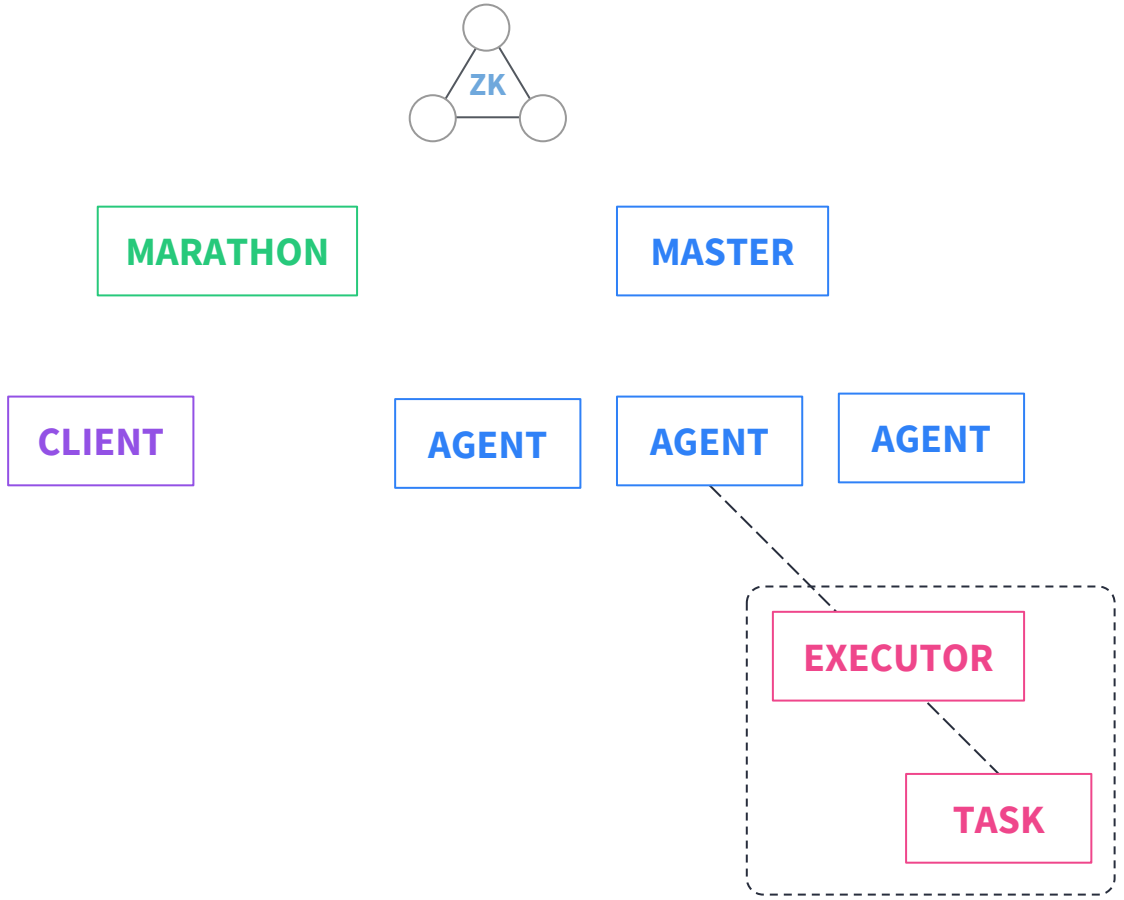

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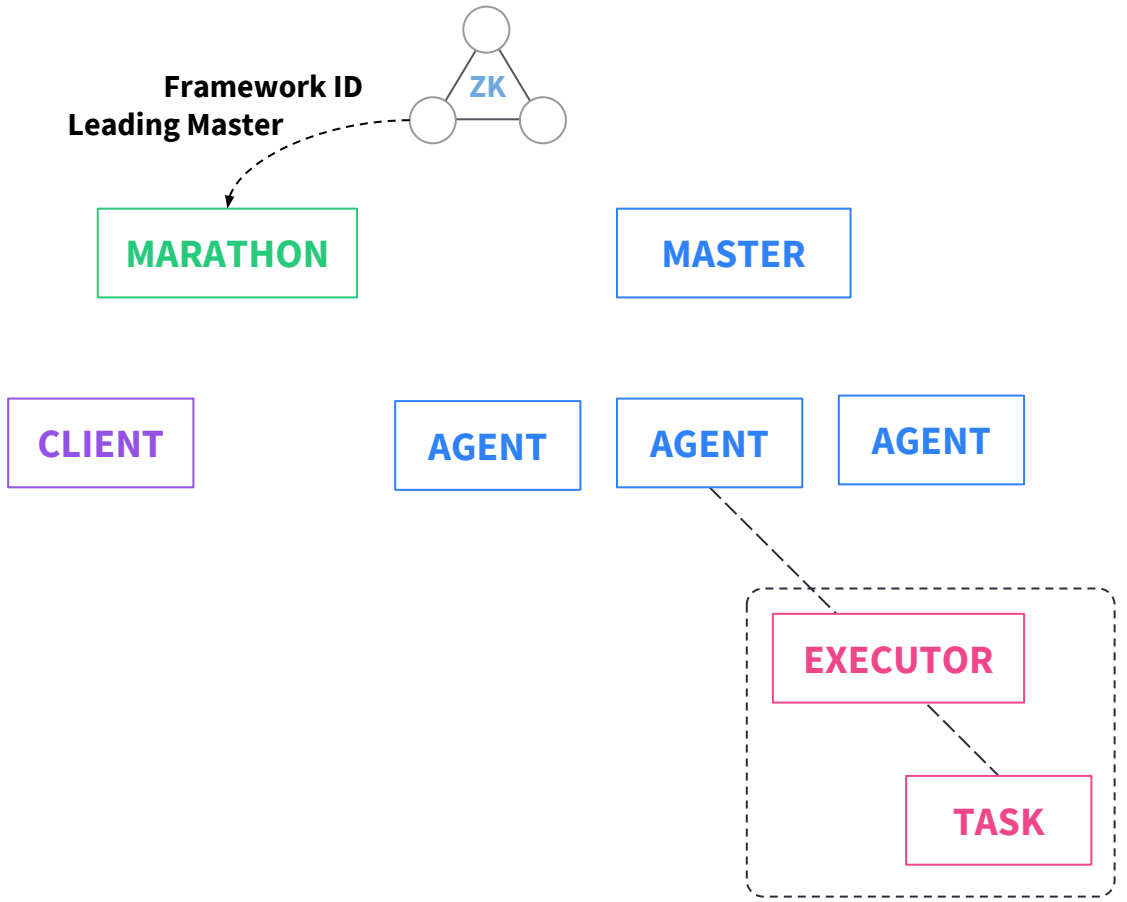

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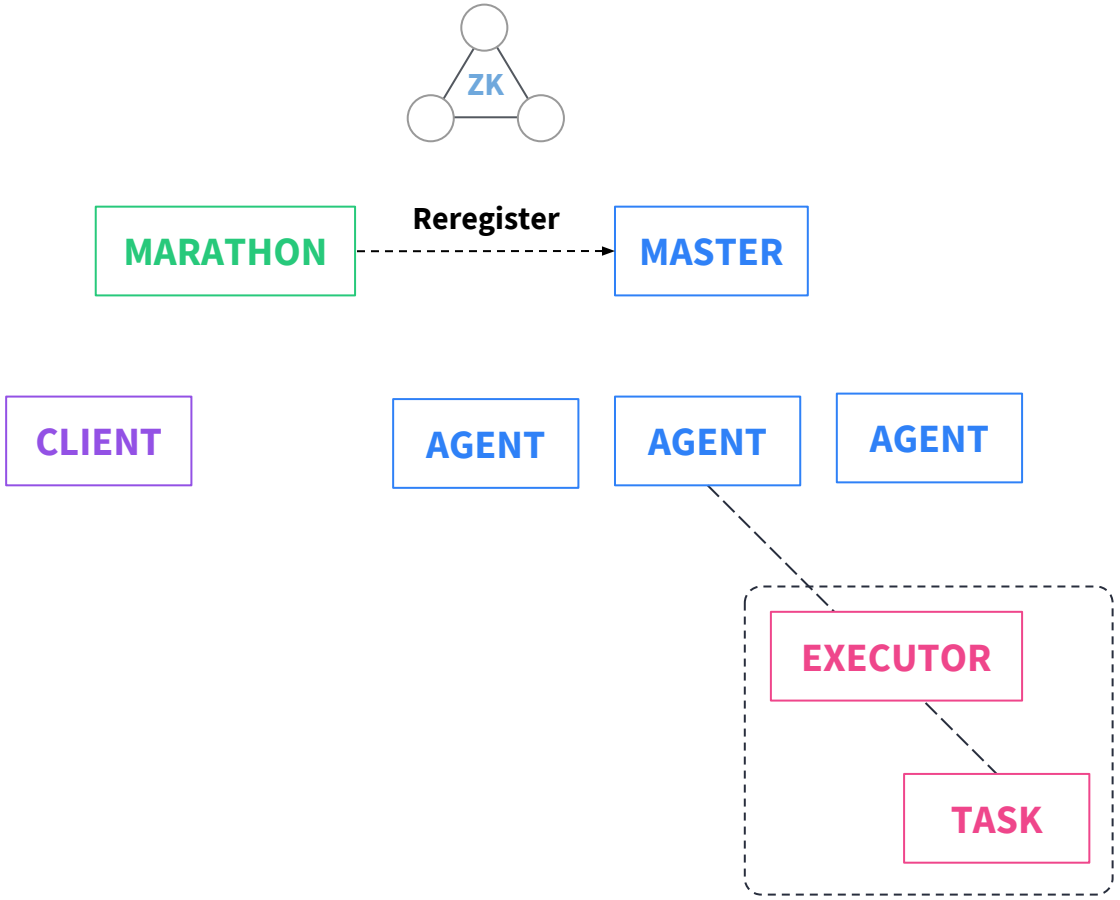

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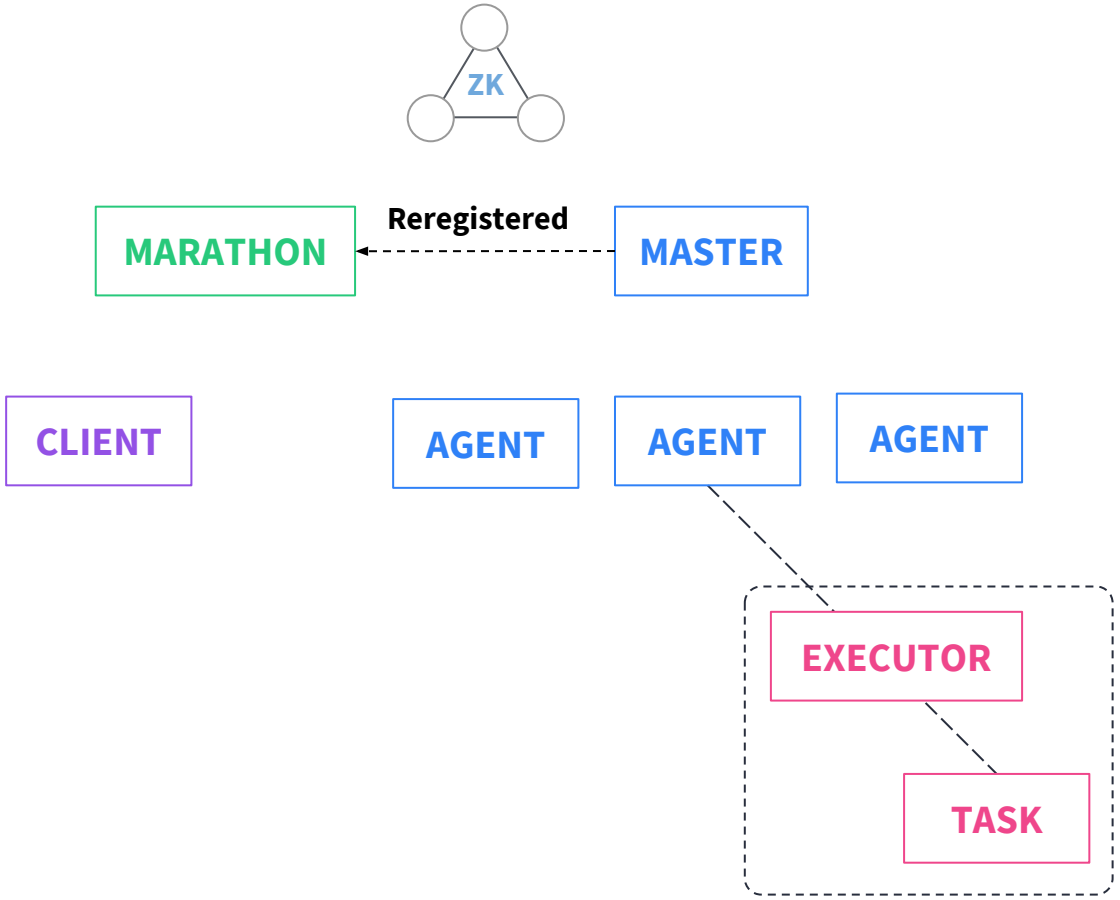

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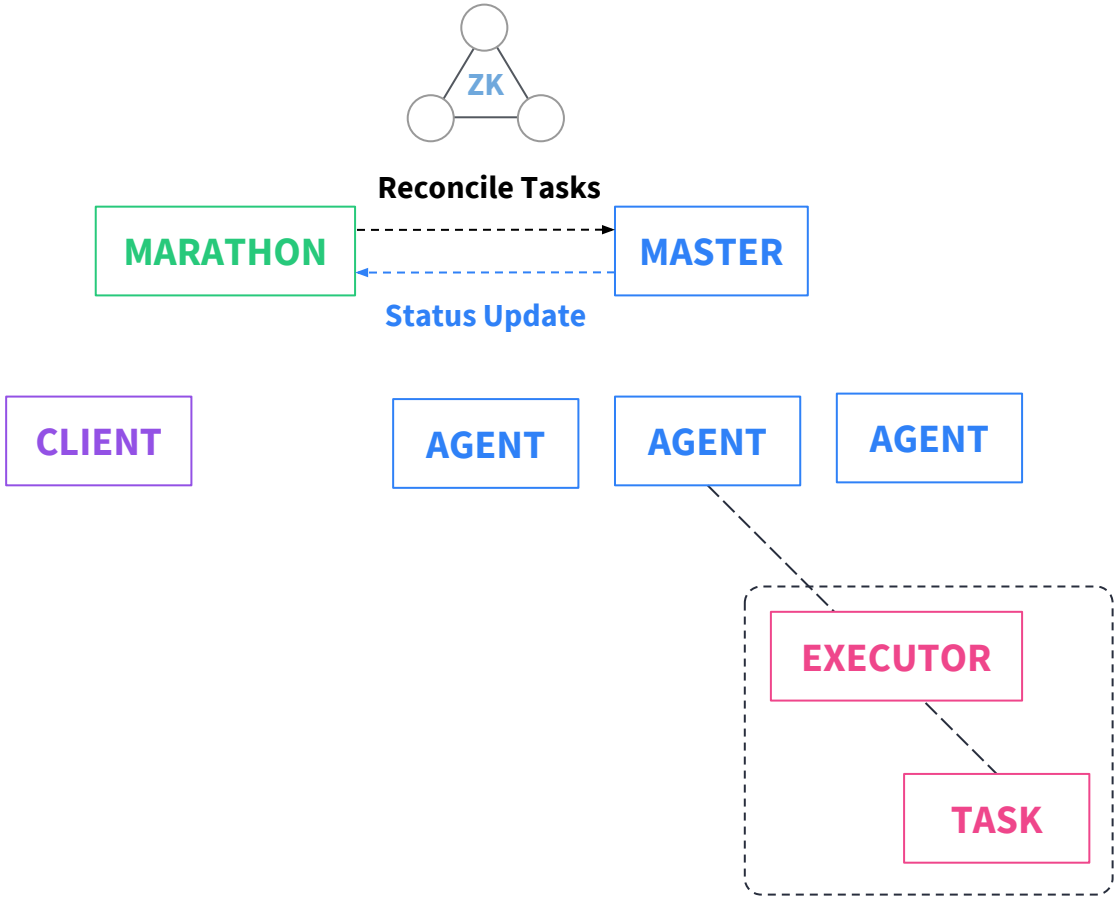


ORCHESTRATION

CONTAINER ORCHESTRATION

CONTAINER ORCHESTRATION

CONTAINER SCHEDULING

RESOURCE MANAGEMENT

SERVICE MANAGEMENT

CONTAINER ORCHESTRATION

CONTAINER SCHEDULING

- Placement
- Replication/Scaling
- Resurrection
- Rescheduling
- Rolling Deployment
- Upgrades
- Downgrades
- Collocation

RESOURCE MANAGEMENT

- Memory
- CPU
- GPU
- Volumes
- Ports
- IPs
- Images/Artifacts

SERVICE MANAGEMENT

- Labels
- Groups/Namespaces
- Dependencies
- Load Balancing
- Readiness Checking

The SMACK Stack

EVENTS

Ubiquitous data streams from connected devices

INGEST

Ingest millions of events per second

ANALYZE

Real-time and batch process data

STORE

Distributed & highly scalable database

ACT

Visualize data and build data driven applications

Sensors

Devices

Clients

Apache Kafka

Apache Spark

Apache Cassandra

Akka

Mesos/ DC/OS

METRICS

MONITORING

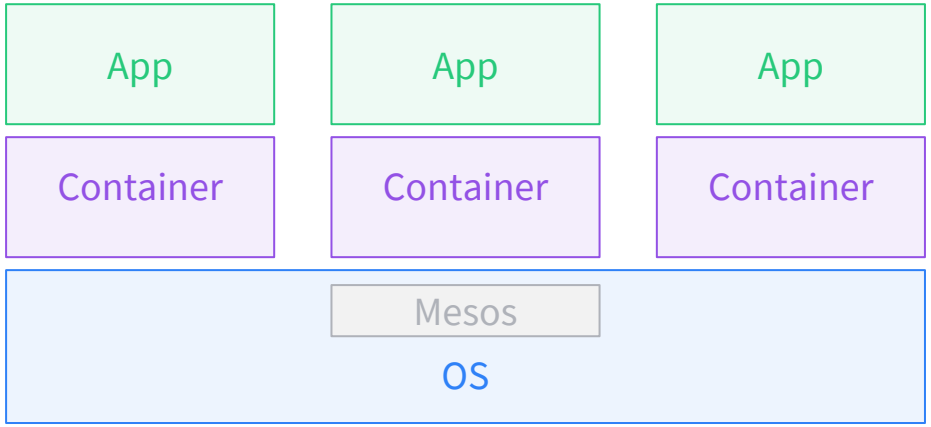
METRICS

Measurements captured to determine health and performance of cluster

- How utilized is the cluster?
- Are resources being optimally used?
- Is the system performing better or worse over time?
- Are there bottlenecks in the system?
- What is the response time of applications?

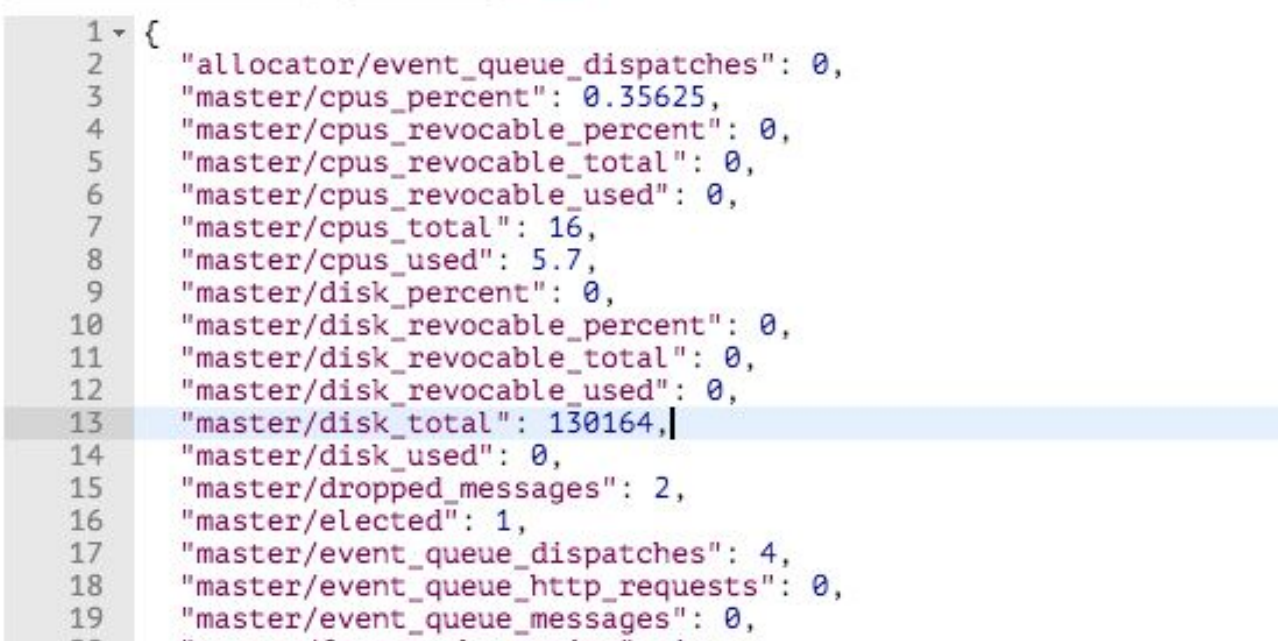
DC/OS METRIC SOURCES

- Mesos metrics
  - Resource, frameworks, masters, agents, tasks, system, events
- Container Metrics
  - CPU, mem, disk, network
- Application Metrics
  - QPS, latency, response time, hits, active users, errors



MESOS MASTER METRICS

- Metrics for the master node are available at the following URL:
  - `http://<mesos-master-ip>/mesos/master/metrics/snapshot`
  - The response is a JSON object that contains metrics names and values as key-value pairs.
- Metric Groups:
  - Resources
  - Master
  - System
  - Slaves
  - Frameworks
  - Tasks
  - Messages
  - Event Queue
  - Registrar



MESOS MASTER BASIC ALERTS

Metric Value	Inference
master/uptime_secs is low	The master has restarted
master/uptime_secs < 60 for sustained periods of time	The cluster has a flapping master node
master/tasks_lost is increasing rapidly	Tasks in the cluster are disappearing. Possible causes include hardware failures, bugs in one of the frameworks or bugs in Mesos
master/slaves_active is low	Slaves are having trouble connecting to the master
master/cpus_percent > 0.9 for sustained periods of time	DCOS Cluster CPU utilization is close to capacity
master/mem_percent > 0.9 for sustained periods of time	DCOS Cluster Memory utilization is close to capacity
master/disk_used & master/disk_percent	DCOS Disk space consumed by Reservations
master/elected is 0 for sustained periods of time	No Master is currently elected

DEMO?

Join the DC/OS Community

Connect with our community of users and browse the latest DC/OS news.

GitHub

Are you interested in helping us make DC/OS even better? Let's work together! Check out our source code on GitHub.

View repositories →

Slack

Have any questions? Our Slack channel is the best place to get help. Just send us a request to automatically receive your invitation.

Join chat →

Mailing List

Want to stay in the loop and connect with other community members? Our public mailing list has all the latest updates. Join the discussion.

Join users@dcos.io →