Hortonworks

Deploying & Managing distributed apps on YARN

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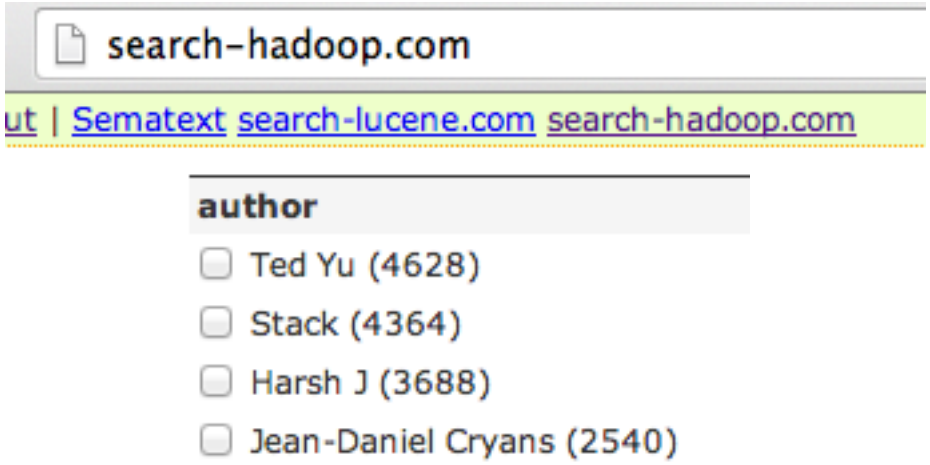
About myself

- HBase committer / PMC member
- Slider committer
- YARN / HDFS contributor



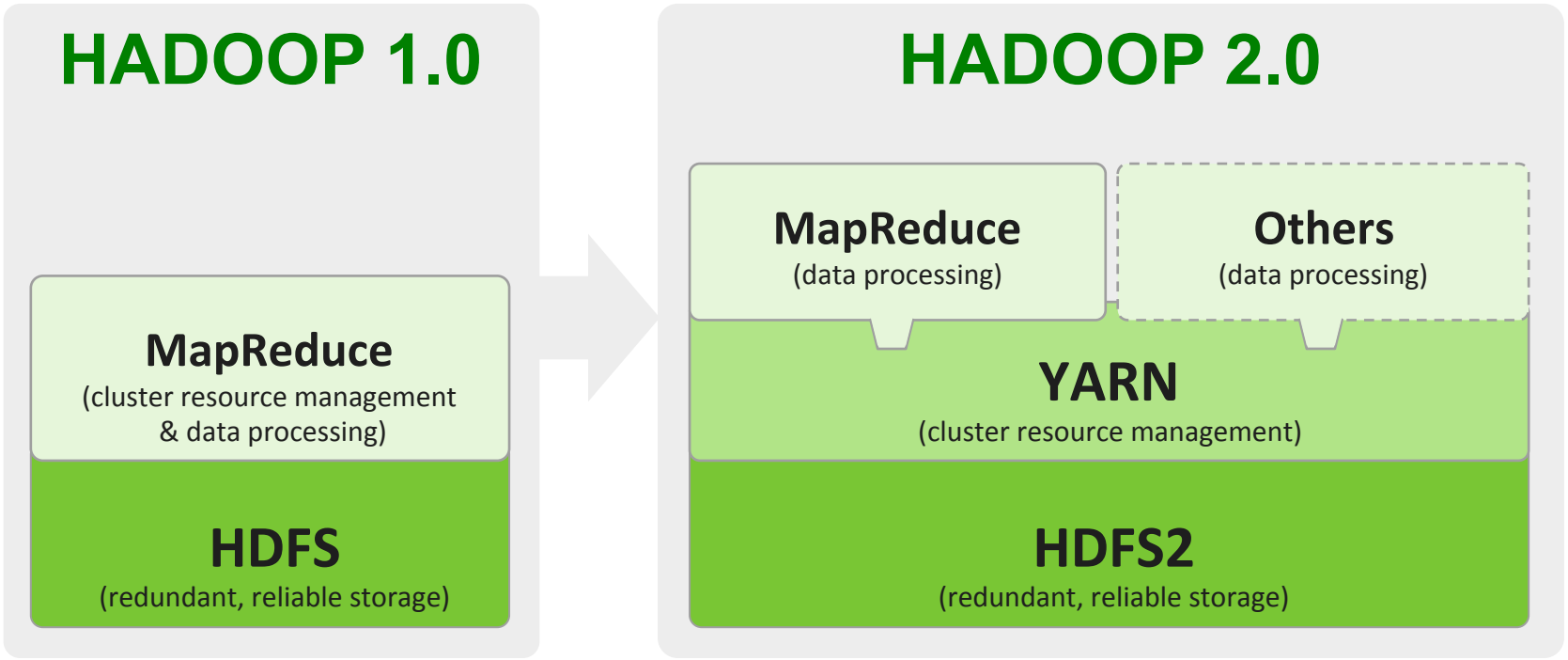
Hadoop as Next-Gen Platform

Single Use System

Batch Apps

Multi Purpose Platform

Batch, Interactive, Online, Streaming, …

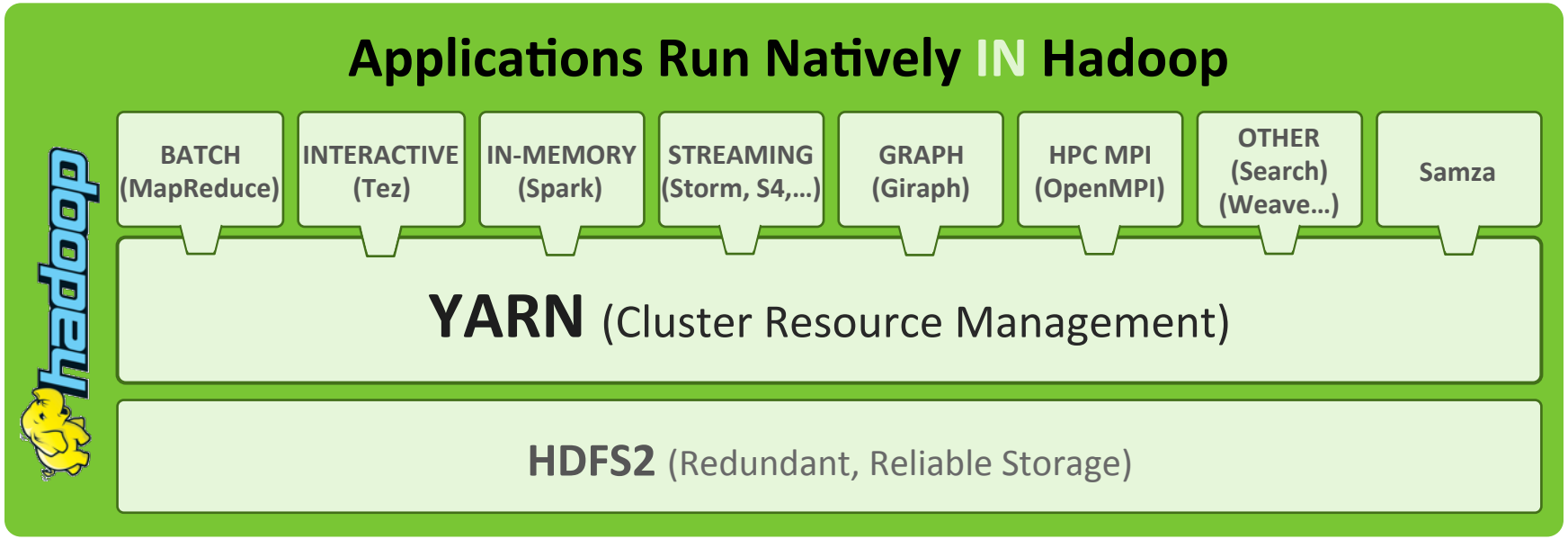


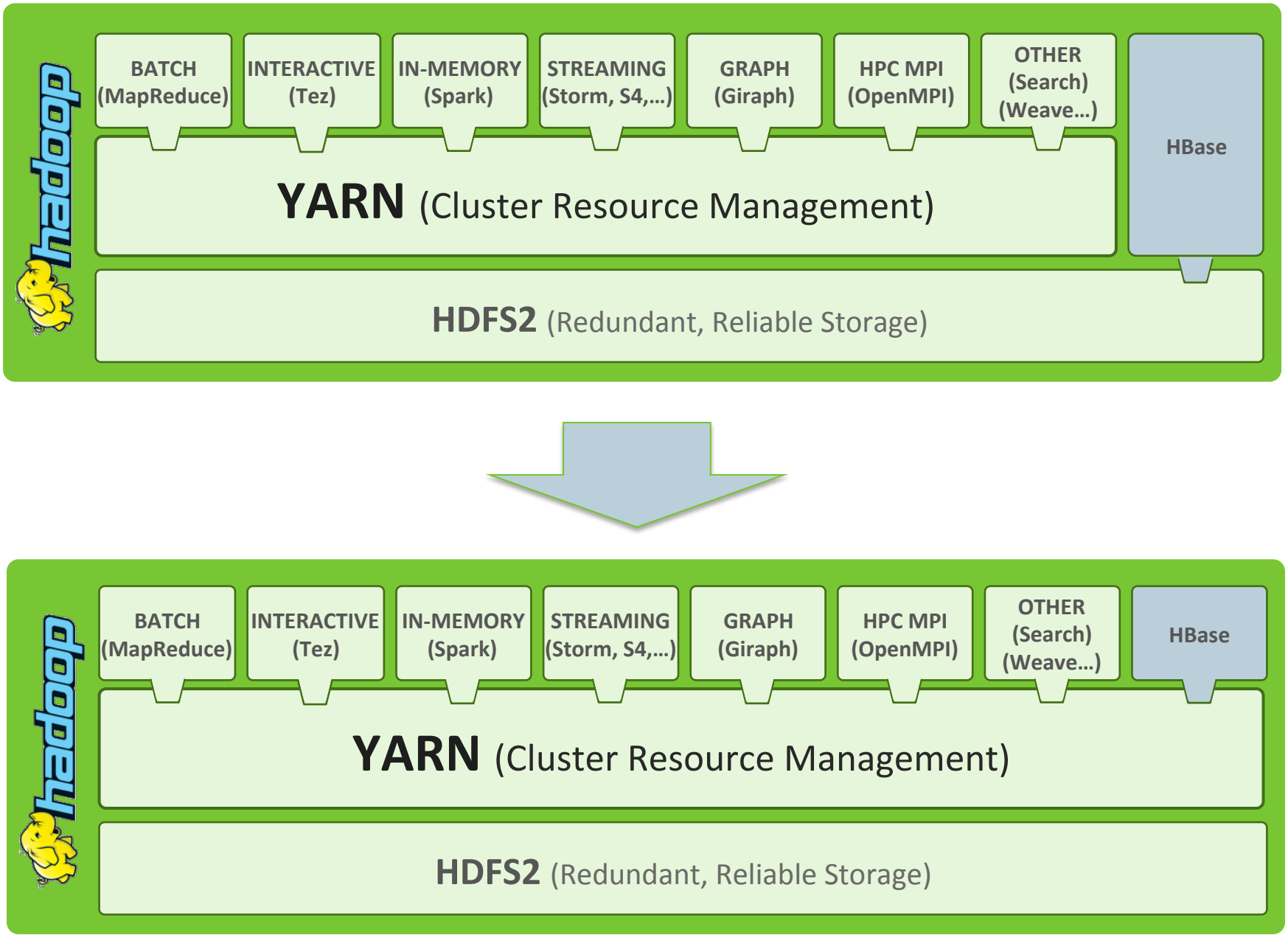
Slider

Availability (always-on)

Flexibility (dynamic scaling)

Resource Management (optimization)




hadoop
BATCH (MapReduce)
INTERACTIVE (Tez)
IN-MEMORY (Spark)
STREAMING (Storm, S4,…)
GRAPH (Giraph)
HPC MPI (OpenMPI)
OTHER (Search) (Weave…)
HBase
YARN (Cluster Resource Management)
HDFS2 (Redundant, Reliable Storage)
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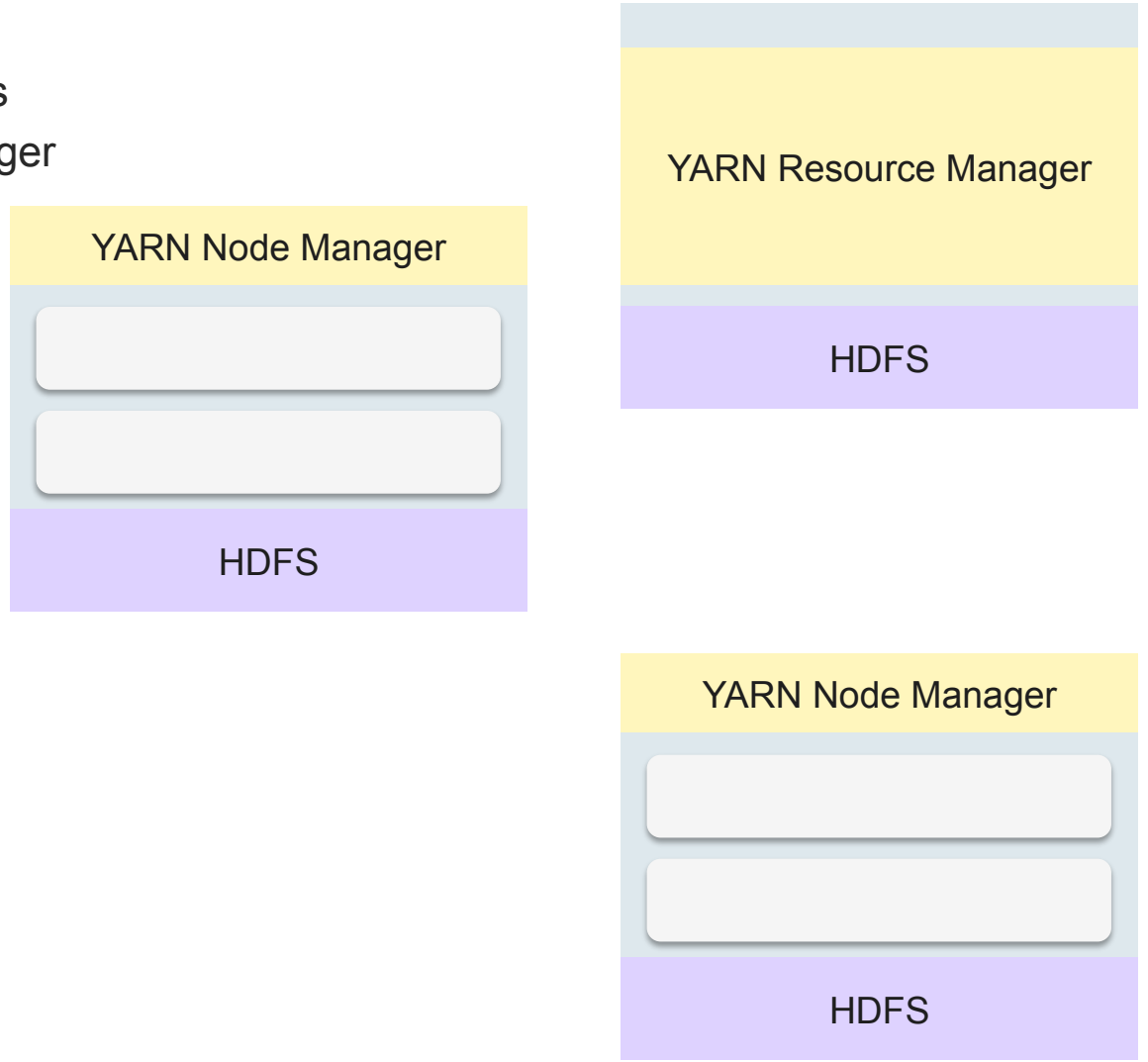
Step 1: Hoya: On-demand HBase

JSON config in HDFS drives cluster setup and config

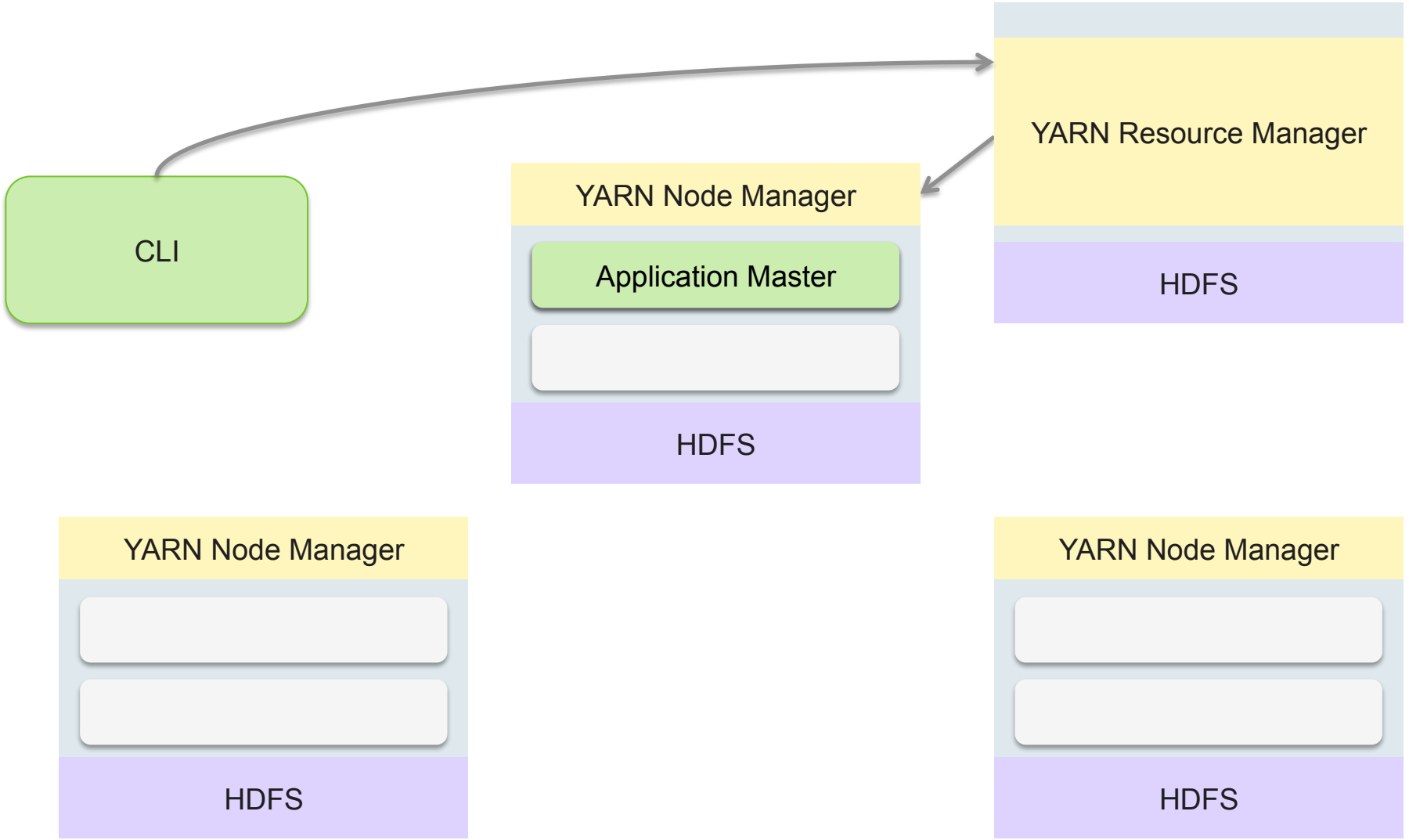
1. Small HBase cluster in large YARN cluster
2. Dynamic, self-healing
3. Freeze / thaw
4. Custom versions & configurations
5. More efficient utilization/sharing of cluster

YARN manages the cluster

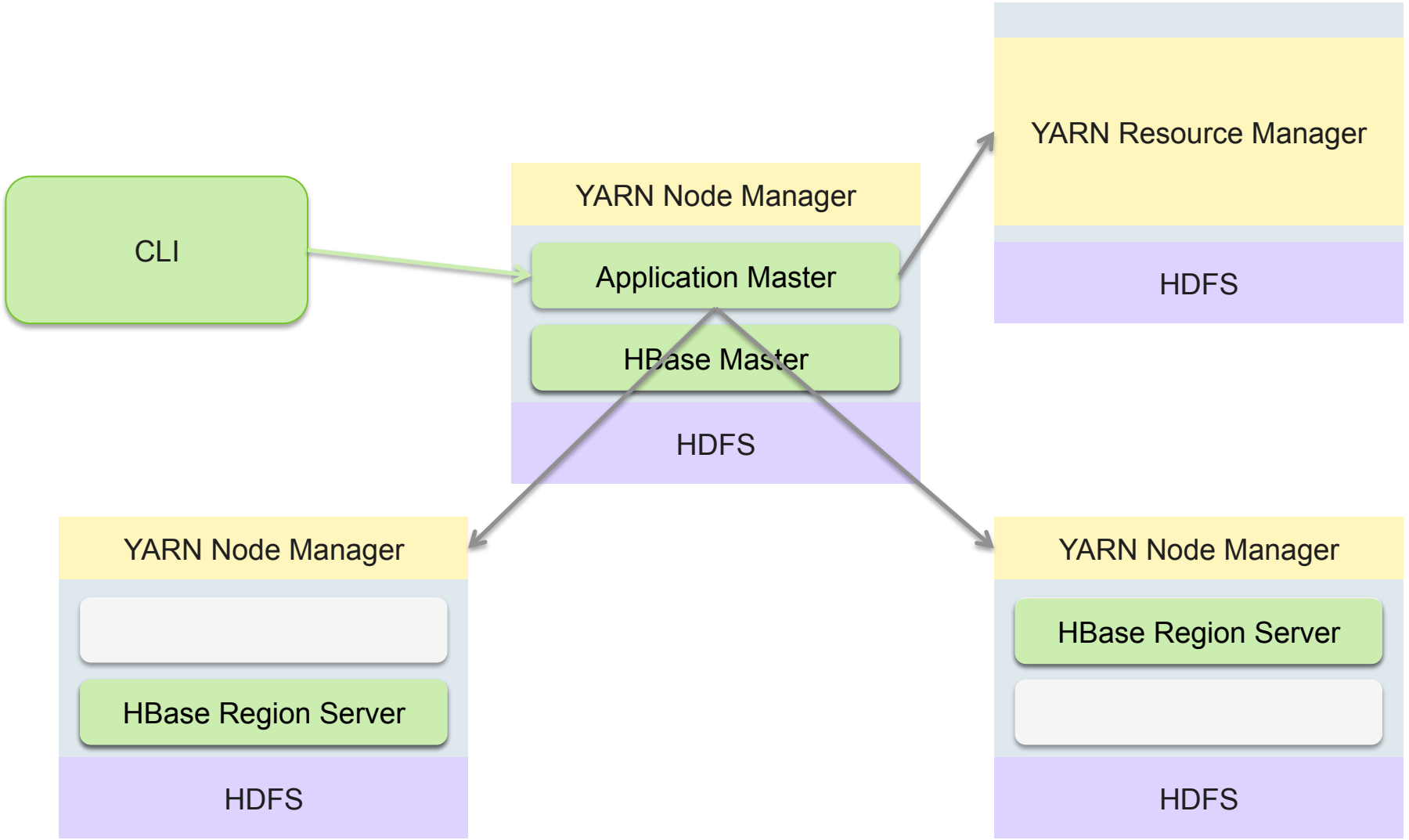
- Servers run YARN Node Managers
- NM's heartbeat to Resource Manager
- RM schedules work over cluster
- RM allocates containers to apps
- NMs start containers
- NMs report container health



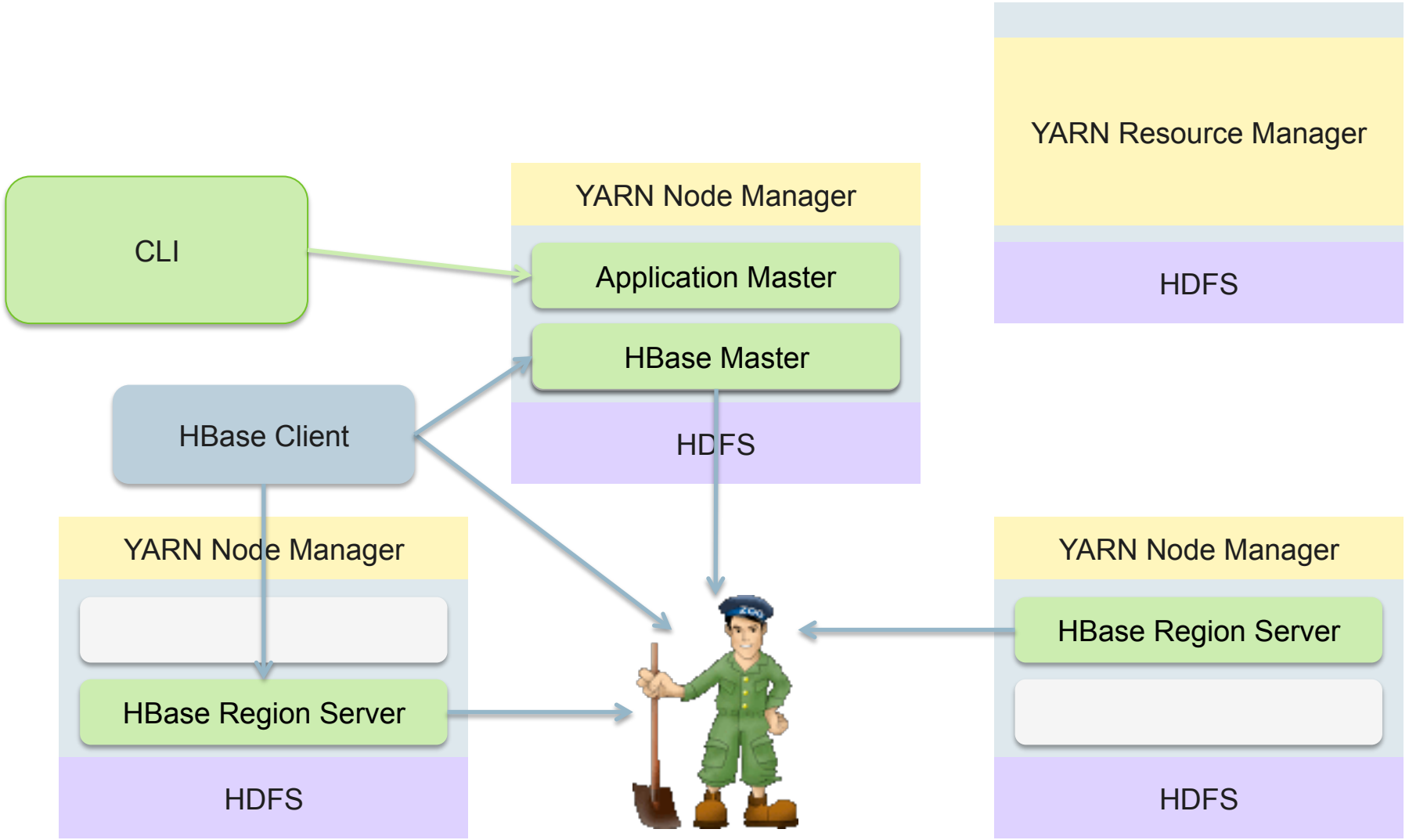
Client creates App Master



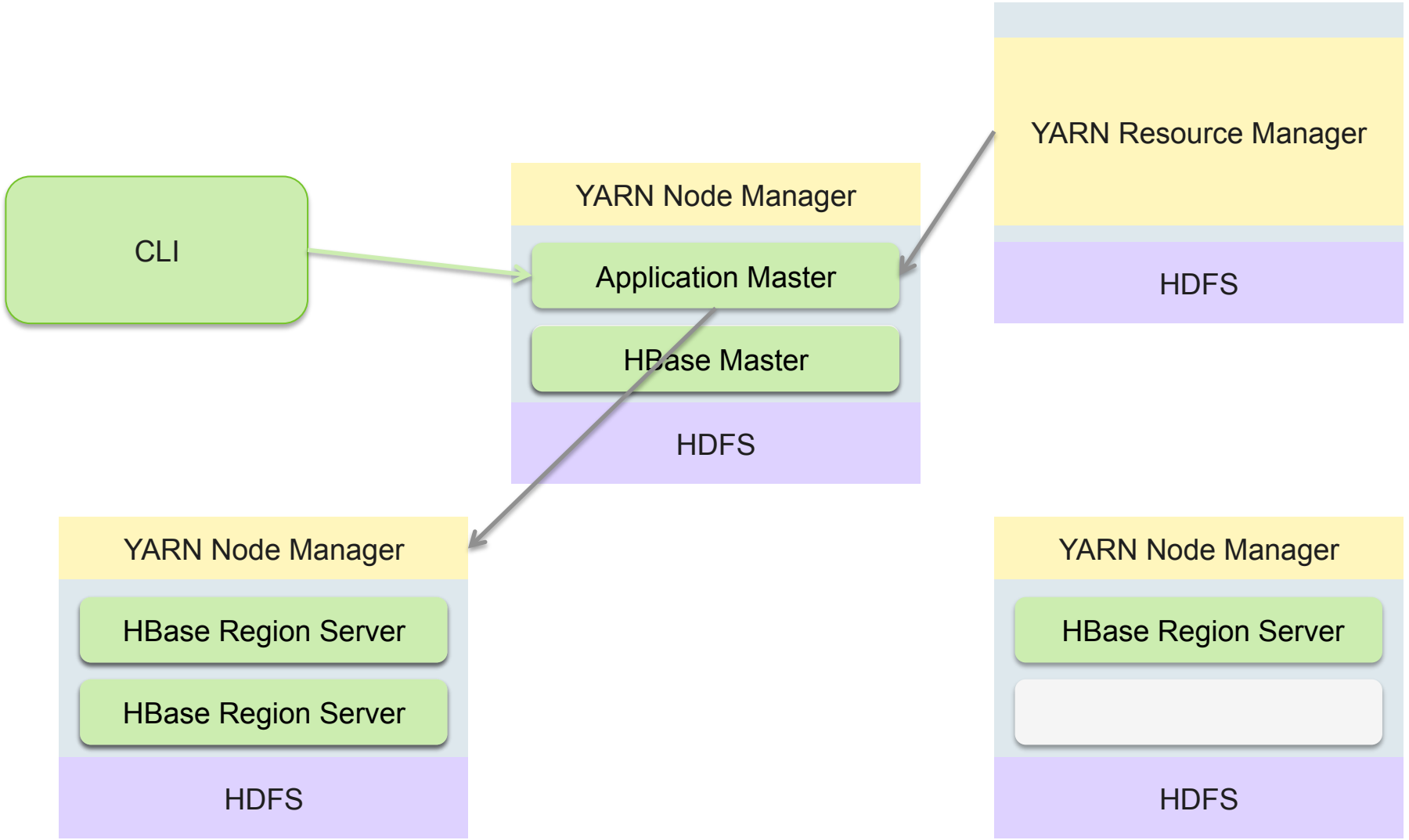
AM deploys HBase with YARN



HBase & clients bind via Zookeeper



YARN notifies AM of failures



JSON Specification

```
{
  "schema" : "http://example.org/specification/v2.0.0",
  "metadata" : {
  },
  "global" : {
   "yarn.vcores" : "1",
   "yarn.memory" : "256",
  },
  "components" : {
    "rs" : {
      "yarn.memory" : "512",
      "yarn.priority" : "2",
      "yarn.instances" : "4"
    },
    "slider-appmaster" : {
      "yarn.instances" : "1"
    },
    "master" : {
      "yarn.priority" : "1",
      "yarn.instances" : "1"
    }
  }
}
```

Flexing/failure handling is same code

```
boolean flexCluster(ConfTree updated) {
  appState.updateResourceDefinitions(updated);
  return reviewRequestAndReleaseNodes();
}

void onContainersCompleted(List<ContainerStatus>
completed) {
  for (ContainerStatus status : completed) {
    appState.onCompletedNode(status);
  }
  reviewRequestAndReleaseNodes();
}
```

Limitations

- Needs app with built in discovery/binding protocol
- Static configuration – no dynamic information
- Kill-without-warning is the sole shutdown mechanism
- Custom Java in client & App Master for each service
- Client code assumed CLI – embedded/PaaS use as common.

Slider

“Imagine starting a farm of tomcat servers hooked up to an HBase cluster you just deployed – servers processing requests forwarded by a load-balancing service”

Slider: evolution of & successor to Hoya

1. Unified packaging format for deployable applications
2. Service registration and discovery
3. Propagation of dynamic config information back to clients
4. Client API for embedding – CLI only one use case.

Goal: no code changes to deploy applications in a YARN cluster

Packaging "RPM for a datacenter"

- Packaging format for deployable applications
- metadata, template configurations
- template logic to go from config to scripts
- simple .py scripts for starting different components in different YARN containers
- future: snapshot, graceful stop

Service Registration and Discovery

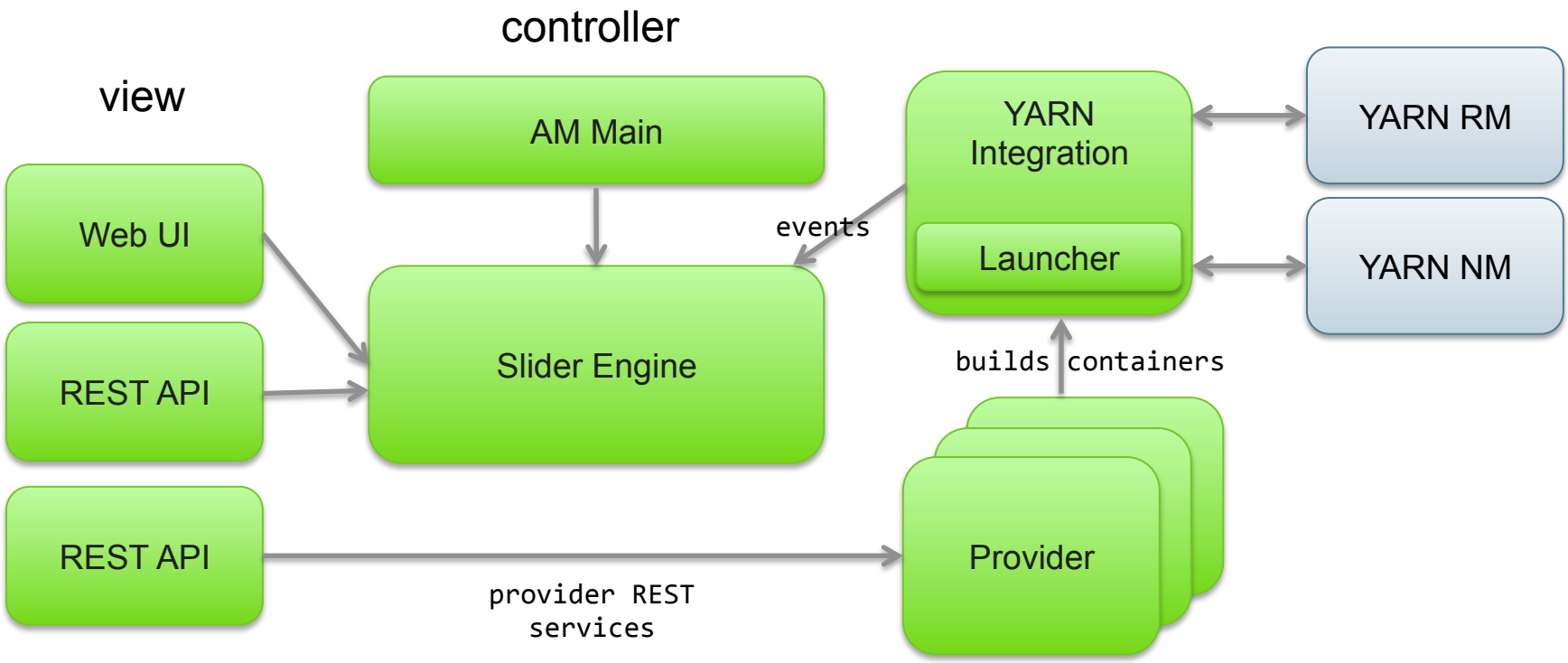
- Applications to publish port bindings (URLs…)
- Applications to publish other config data
- Client APIs to find targeted instance, retrieve bindings and other data
- Generation of client configs. Template-driven.

- See also YARN-913

Slider – the tool

- **Slider**
  - Java tool
  - Completely CLI driven
- **Input: cluster description as JSON**
  - Specification of cluster: node options, ZK params
  - Configuration generated
  - Entire state persisted
- **Actions: create, freeze/thaw, flex, exists <cluster>**
- **Can change cluster state later**
  - Add/remove nodes, started / stopped states

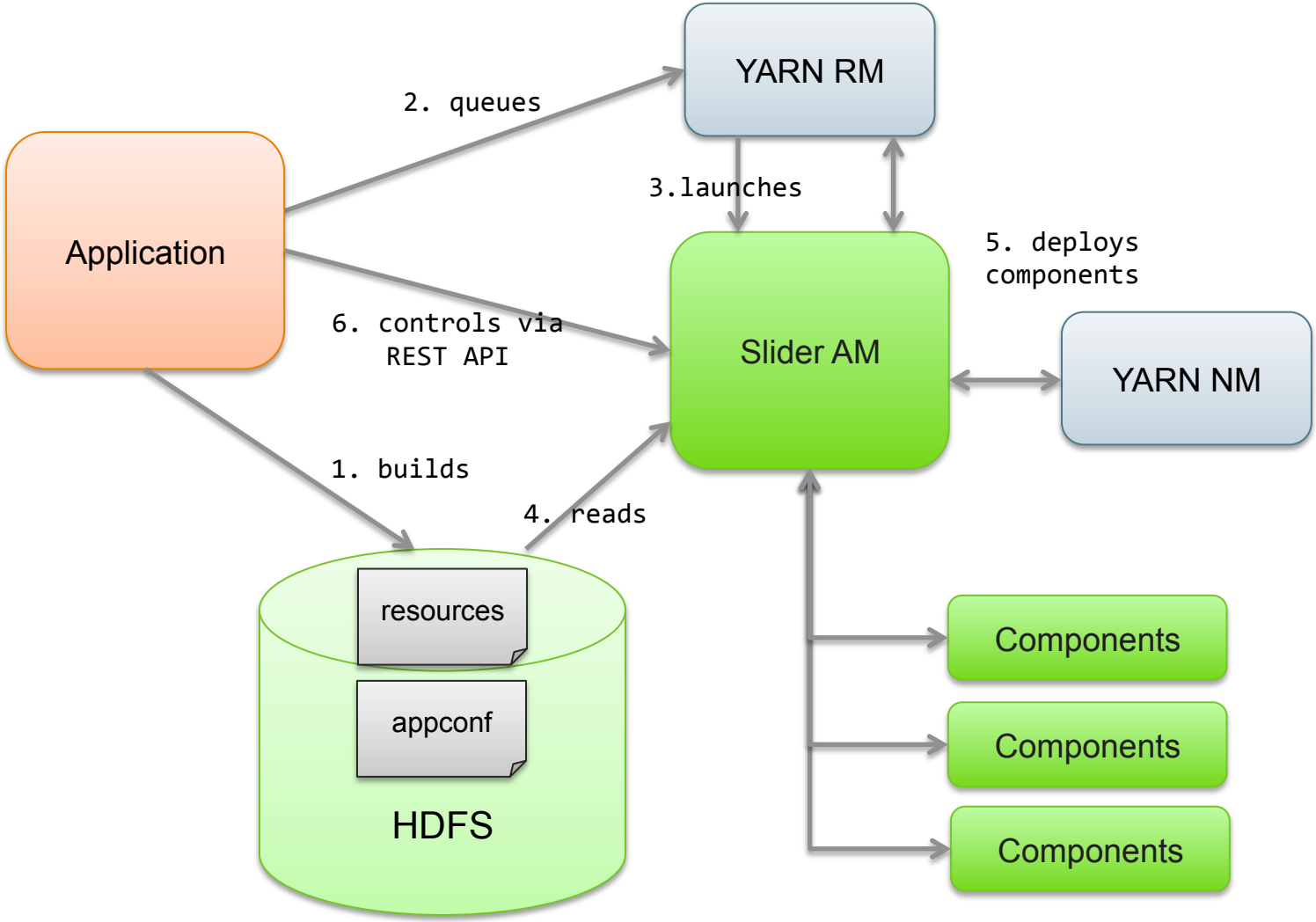
Slider AppMaster



Model

Persisted	Rebuilt	Transient
Specification resources.json appconf.json &c	**NodeMap** model of YARN cluster	**Event History** application history
ComponentHistory persistent history of component placements	**Component Map** container ID -> component instance	**Container Queues** requested, starting, releasing

Slider as a Service



YARN-896: long-lived services

1. Container reconnect on AM restart ✓
2. YARN Token renewal on long-lived apps
3. Containers: signalling (YARN-445), >1 process sequence
4. AM/RM managed gang scheduling
5. Anti-affinity hint in container requests
6. Service Registry (YARN-913)
7. Logging

SLAs & co-existence with MapReduce

1. Make IO bandwidth/IOPs a resource used in scheduling & limits

2. Need to monitor what's going on w.r.t IO & net load from containers ➔ apps ➔ queues

3. Dynamic adaptation of cgroup HDD, Net, RAM limits

4. Could we throttle MR job File & HDFS IO bandwidth?

Status as of April 2014

- Initial agent, REST API, container launch
- Package-based deployments of HBase, Ambari, Storm
- Hierarchical configuration JSON evolving
- Service registry - work in progress
- Incubator: proposal submitted

Questions?

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