Apache Mesos

mesos.apache.org

@ApacheMesos

Benjamin Hindman – @benh

download and install

http://www.apache.org/dyn/closer.cgi/mesos/0.12.1

```
$ tar zxf mesos-0.12.1.tar.gz

$ cd mesos-0.12.1

$ ./configure --prefix=/path/to/install/directory

$ make install
```

releases

maintained	stable	development
0.12.1	0.13.0 (0.13.0-rc7)	0.14.0 (0.14.0-rc1)

development release

```
$ git clone https://git.apache.org/mesos.git

$ cd mesos

$ ./bootstrap

$ ./configure --prefix=/path/to/install/directory

$ make install
```

packages

https://s3.amazonaws.com/mesos-pkg/ubuntu/12.10/mesos_0.14.0_amd64.deb

https://s3.amazonaws.com/mesos-pkg/ubuntu/12.04/mesos_0.14.0_amd64.deb

https://s3.amazonaws.com/mesos-pkg/debian/7.0/mesos_0.14.0_amd64.deb

Contact info@mesosphe.re for more information or other packages

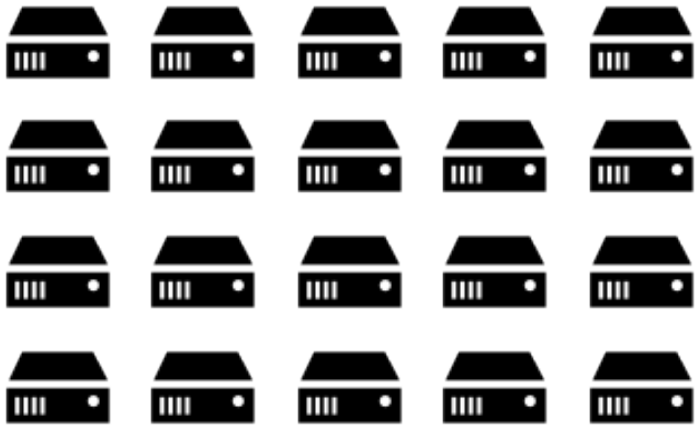
packages

https://github.com/deric/mesos-deb-packaging

packaging support in 0.15.0

nightly/weekly snapshots of development

mesos



starting a master

$ mesos-master --help

$ mesos-master --ip=a.b.c.d

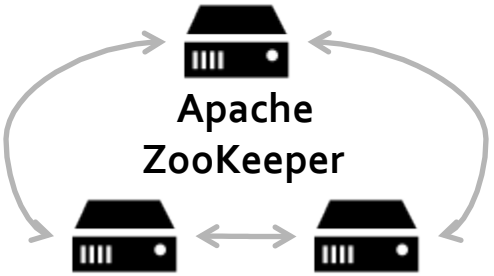
$ MESOS_ip=a.b.c.d mesos-master

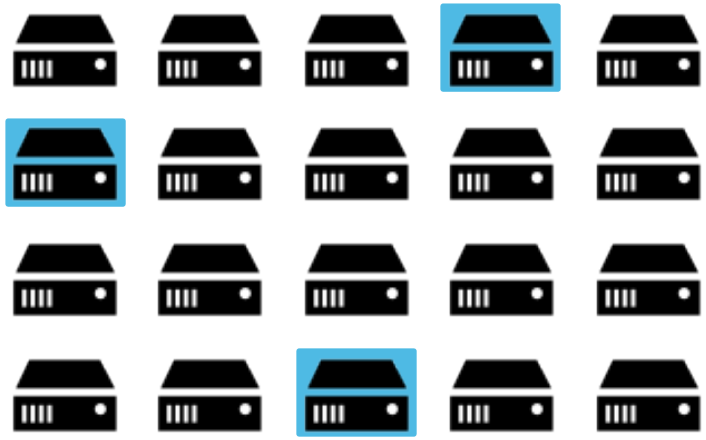
mesos

starting a (fault-tolerant) master

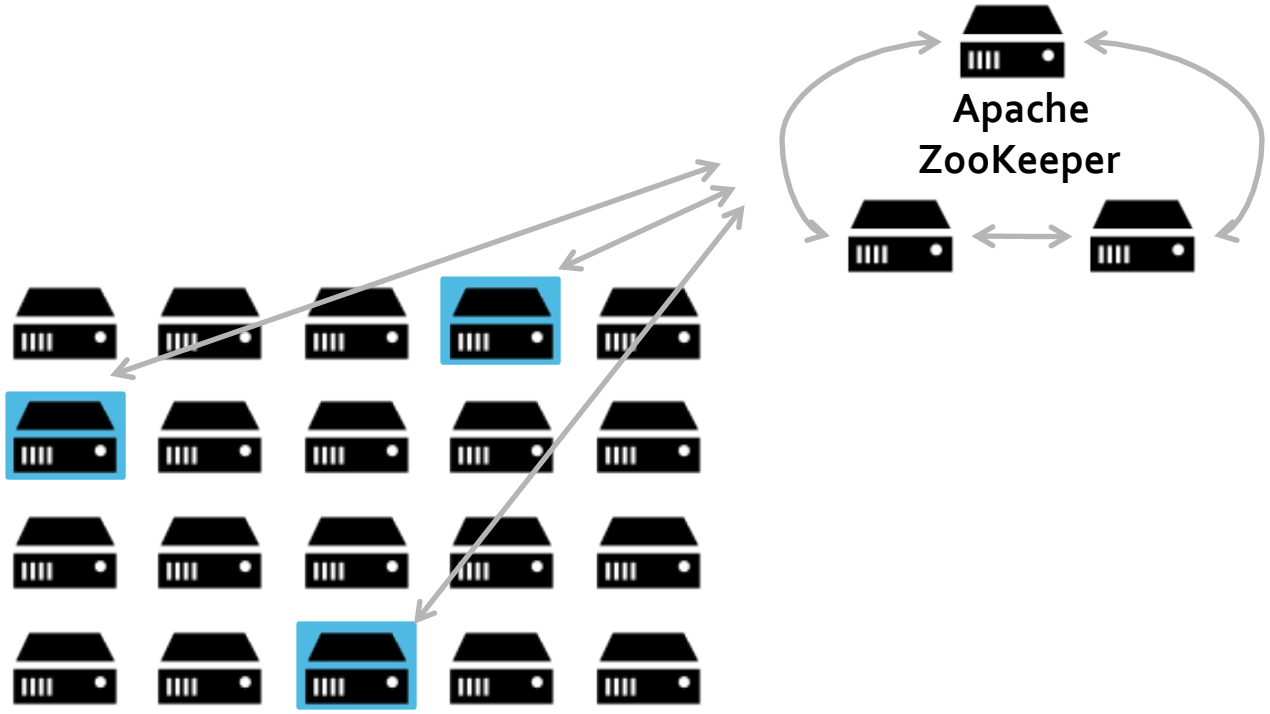
```
$ mesos-master --zk=zk://ip1:port1,ip2:port2,…/mesos
```

mesos





mesos



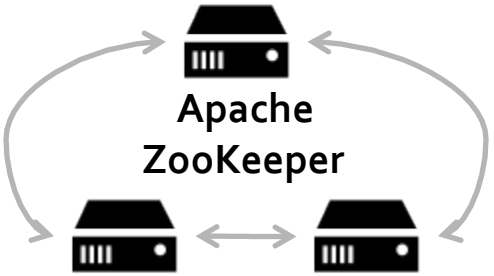
starting a slave

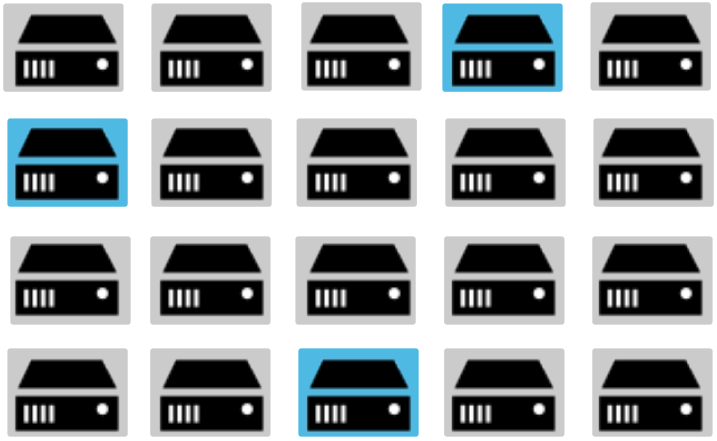
$ mesos-slave –help

$ mesos-slave --master=ip:port

$ mesos-slave --master=zk://ip1:port1,ip2:port2,…/mesos

mesos





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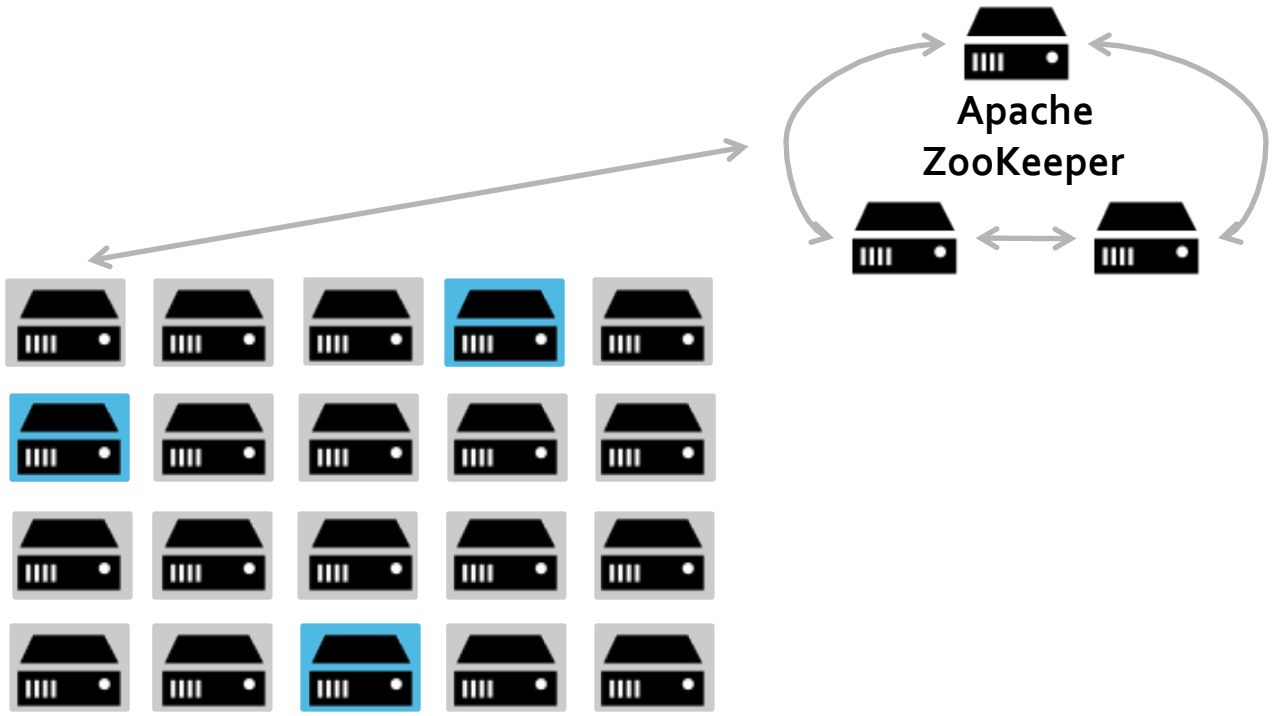

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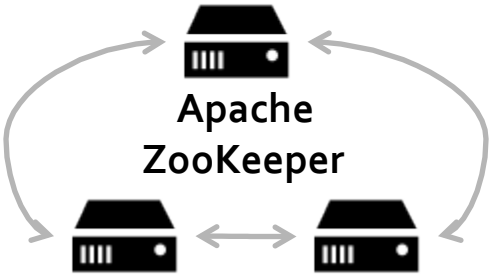
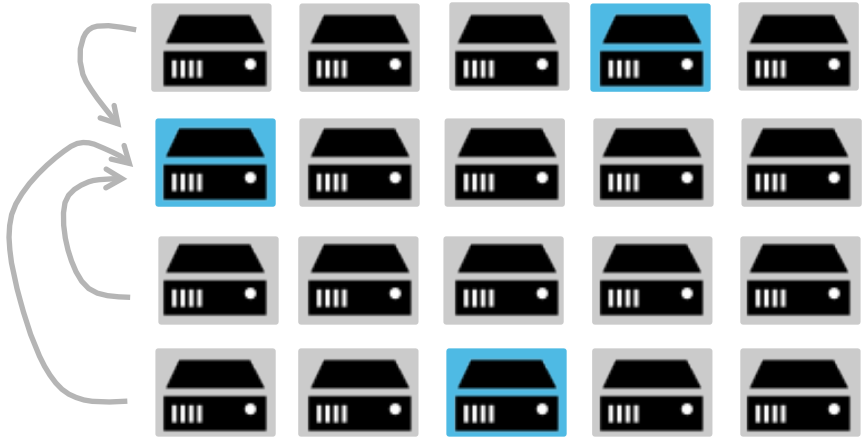




now what?

launch frameworks

what's a framework?

framework

≈

distributed system

frameworks

- Hadoop (github.com/mesos/hadoop)
- Spark (github.com/mesos/spark)
- DPark (github.com/douban/dpark)
- Storm (github.com/nathanmarz/storm)
- Chronos (github.com/airbnb/chronos)
- MPICH2 (not well maintained, email mailing list)

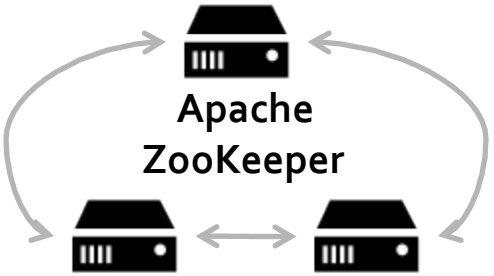
framework commonality

run processes simultaneously (*distributed*)

handle process failures (*fault-tolerance*)

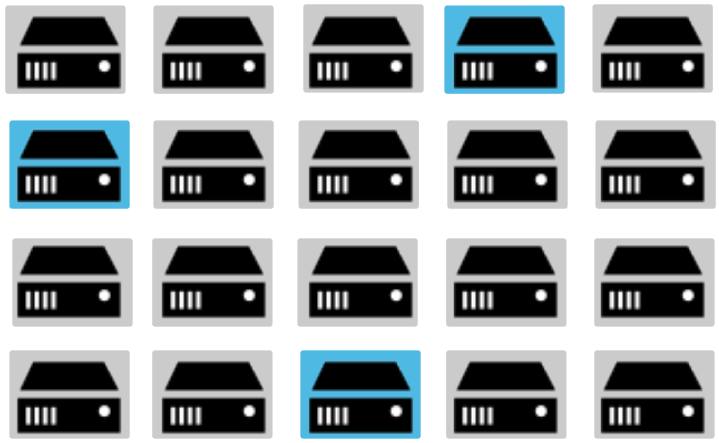
optimize execution (*elasticity, scheduling*)

mesos



Apache
Hadoop

Chronos



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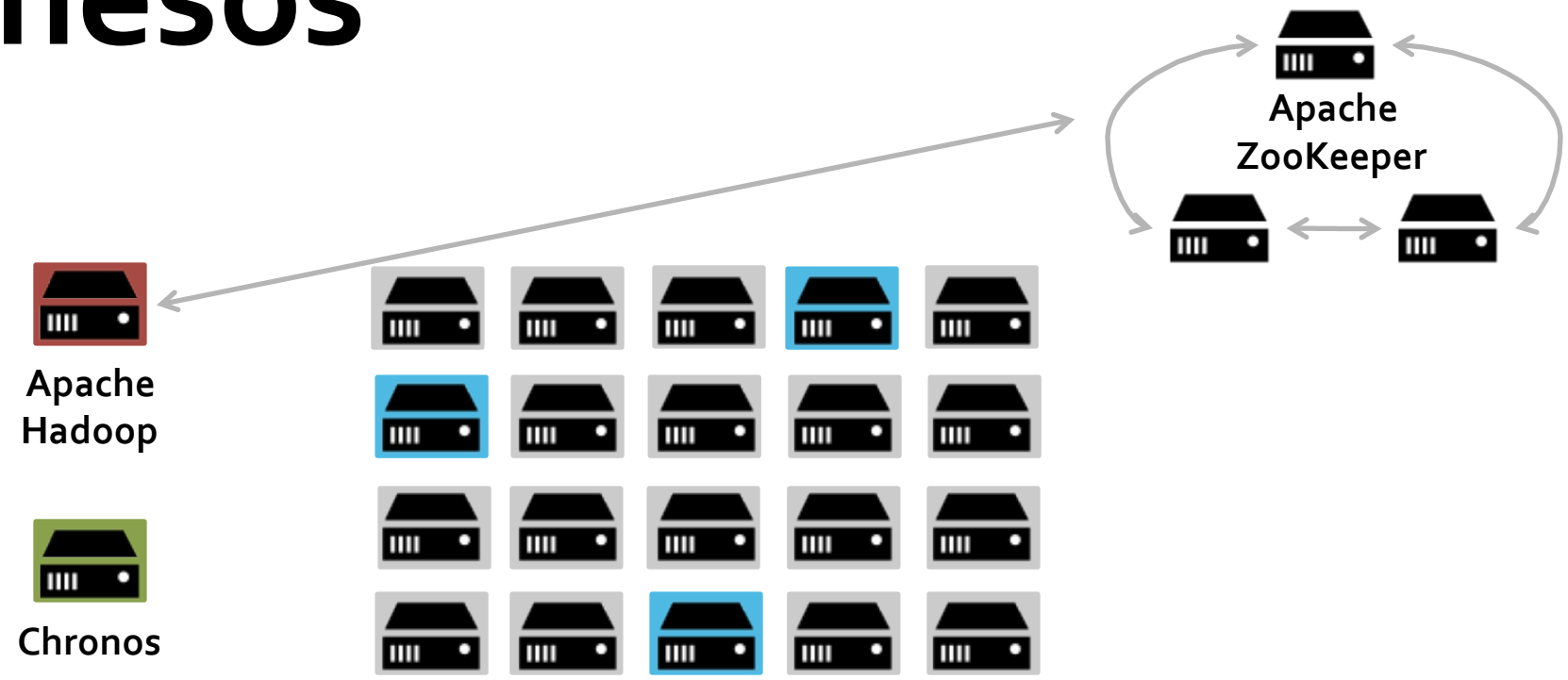

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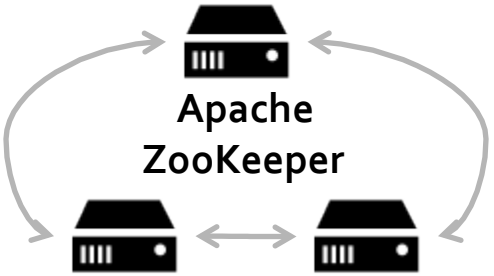

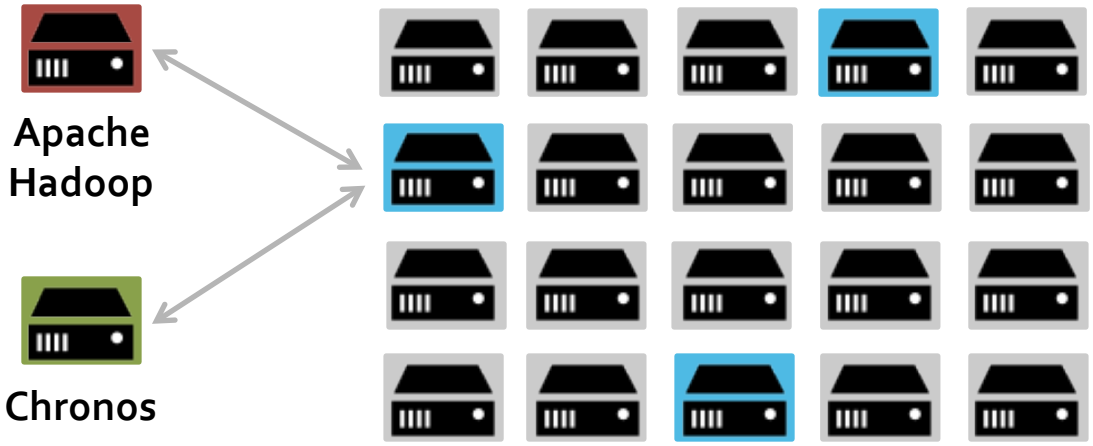

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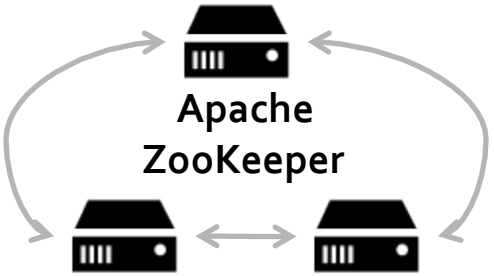

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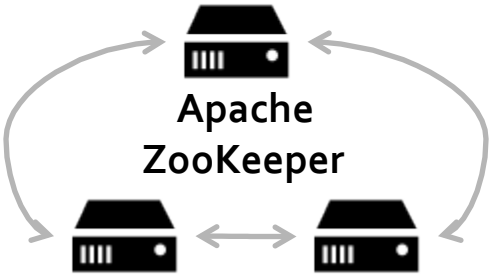

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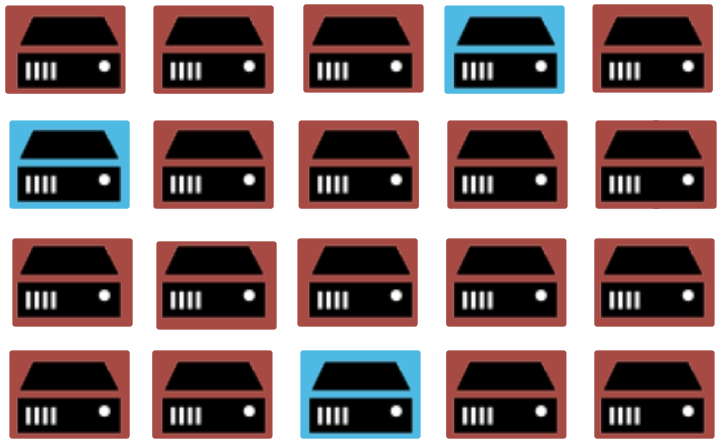


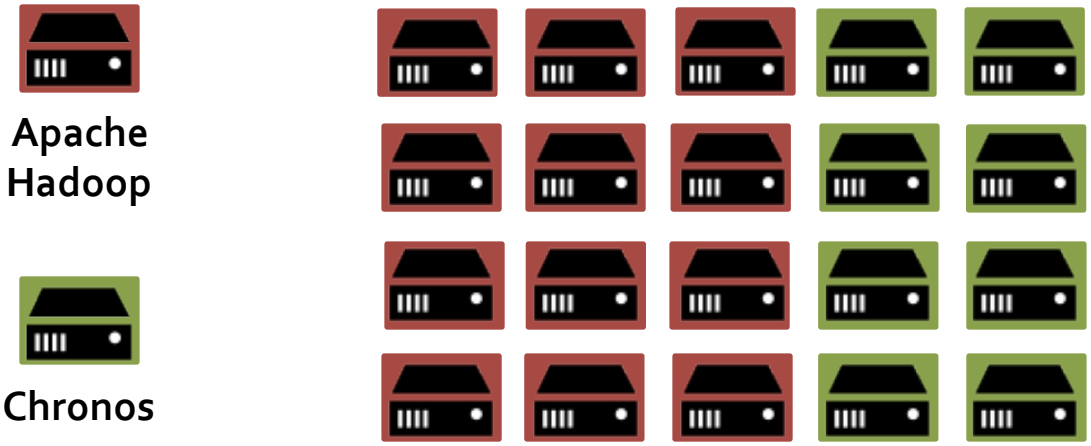
but why?

origins

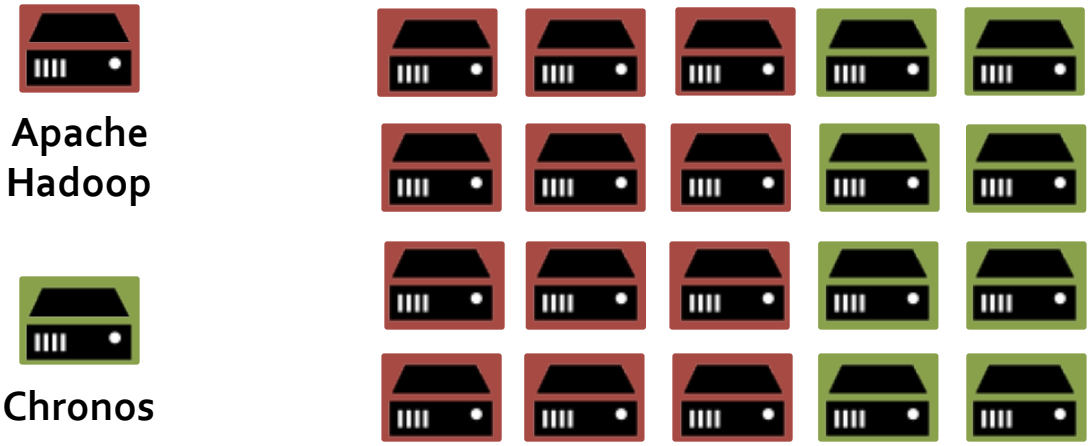
Berkeley research project including Benjamin Hindman, Andy Konwinski, Matei Zaharia, Ali Ghodsi, Anthony D. Joseph, Randy Katz, Scott Shenker, Ion Stoica

mesos.apache.org/documentation

static partitioning



static partitioning considered harmful



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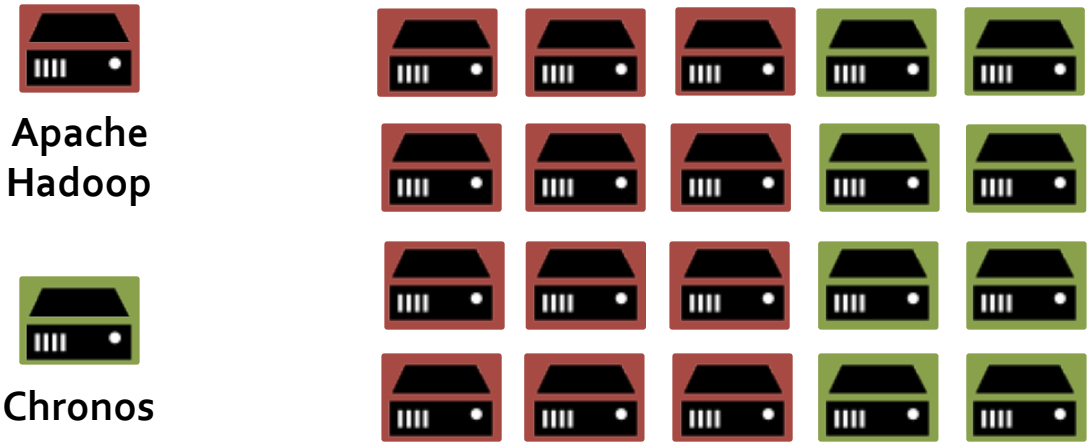

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(e.g., 72 GB RAM and 24 CPUs)

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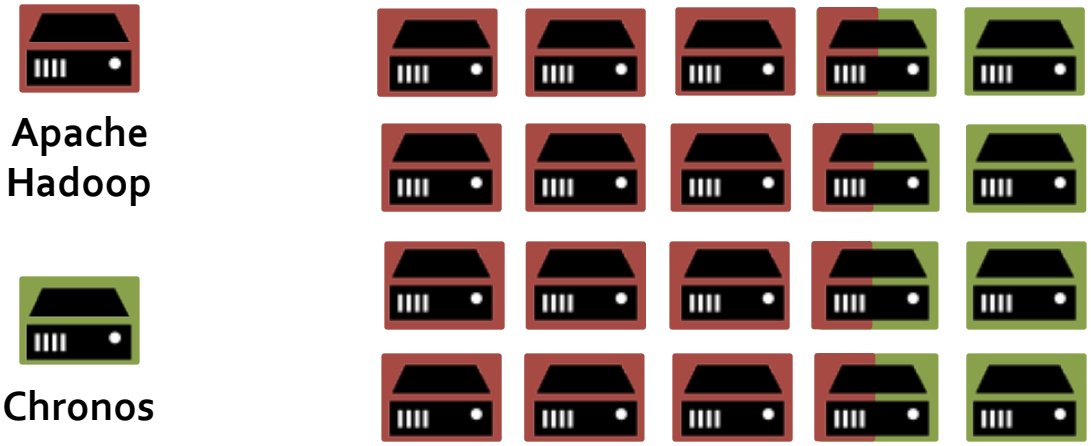

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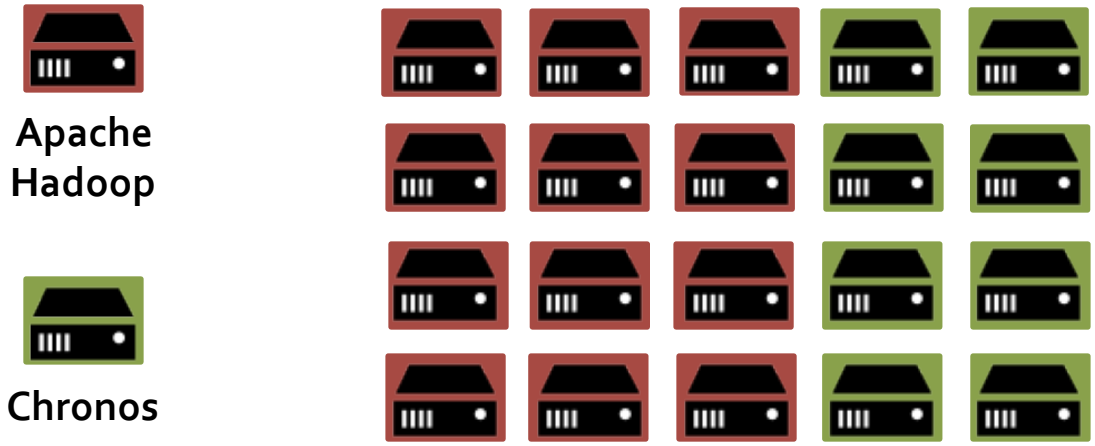

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(to take advantage of statistical multiplexing)

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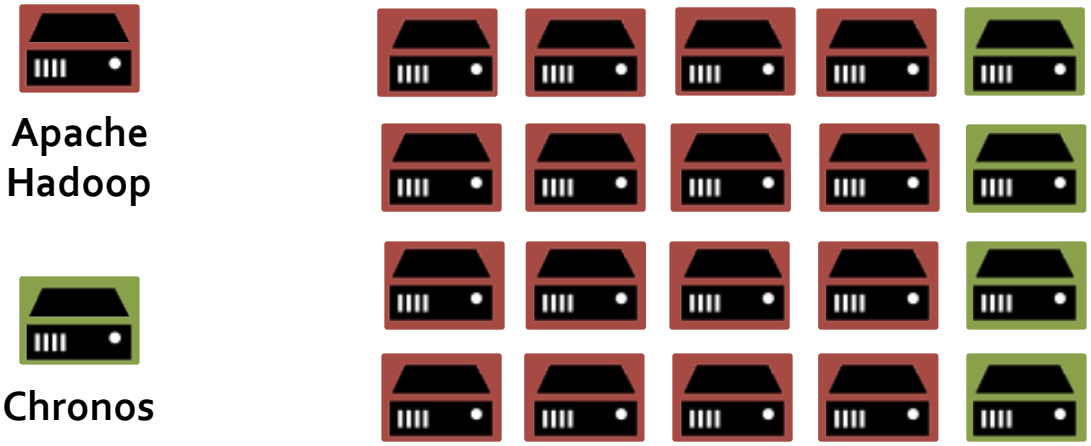

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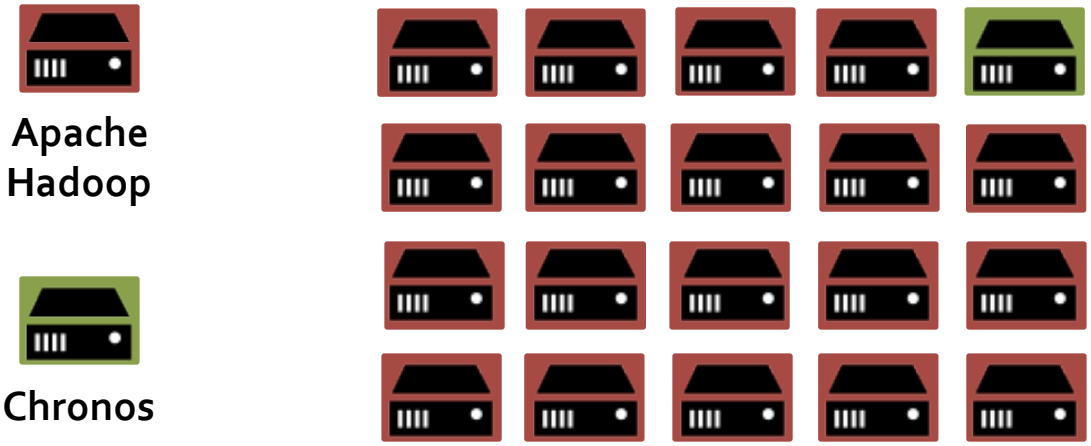

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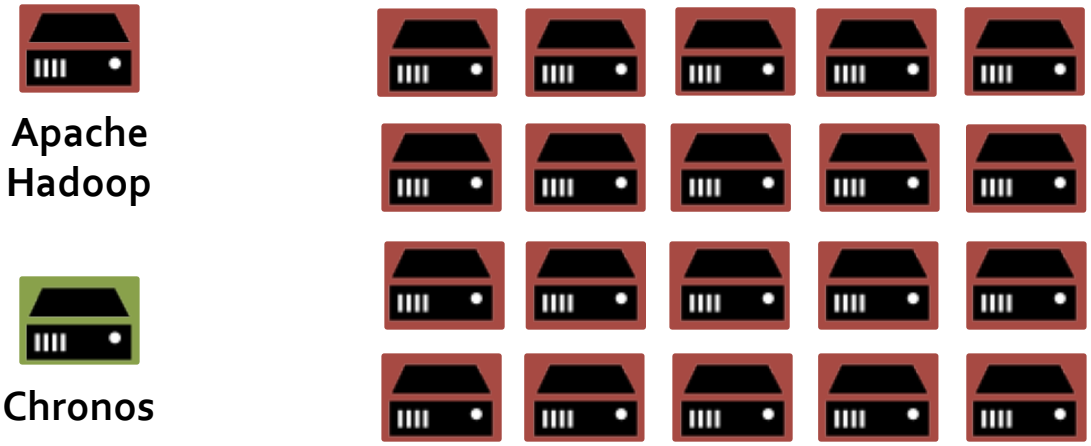

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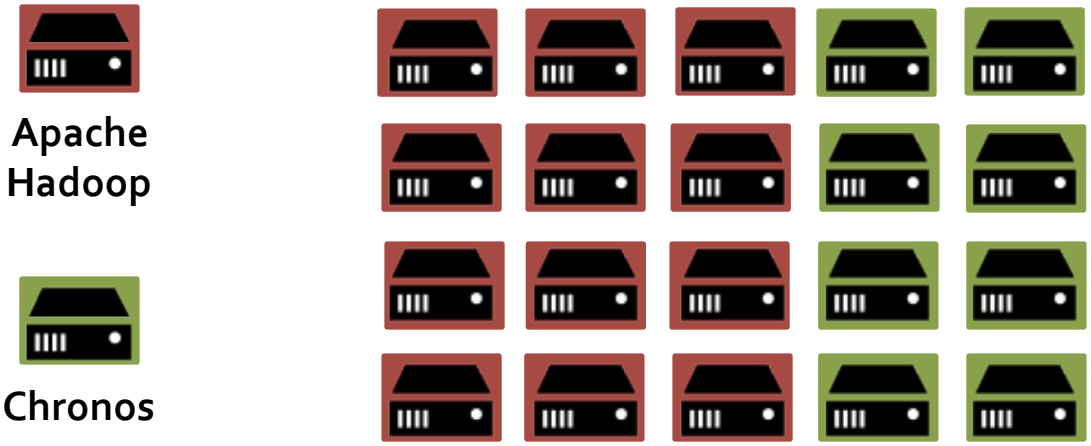

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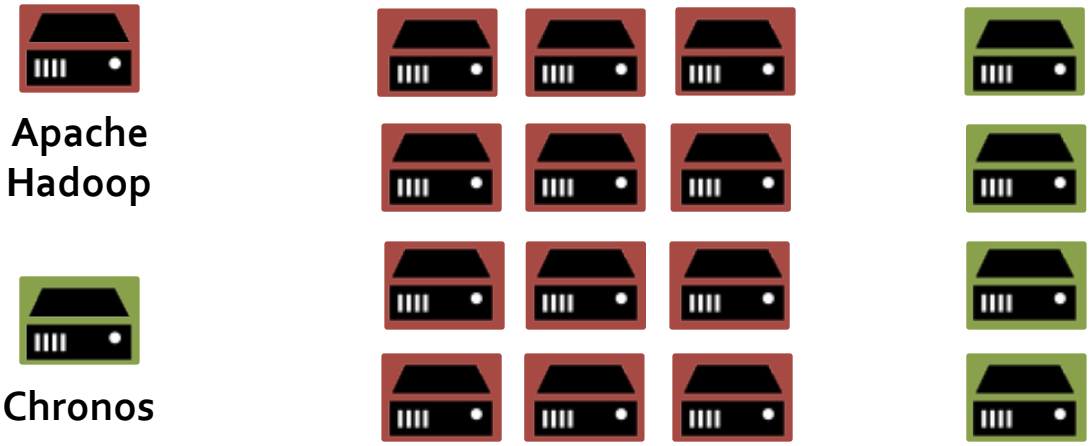

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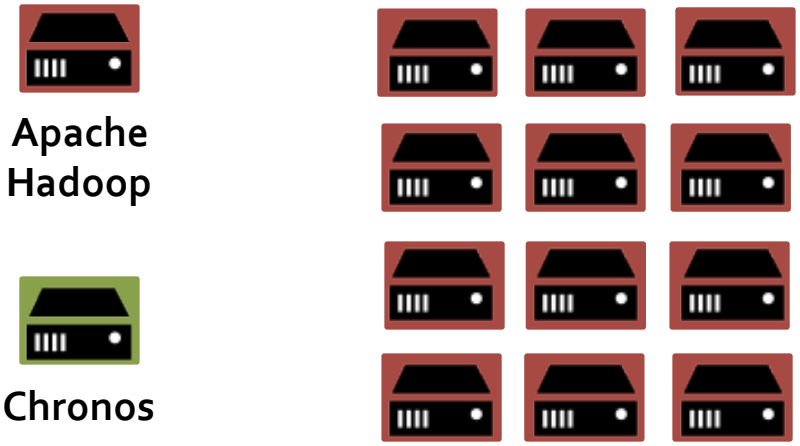

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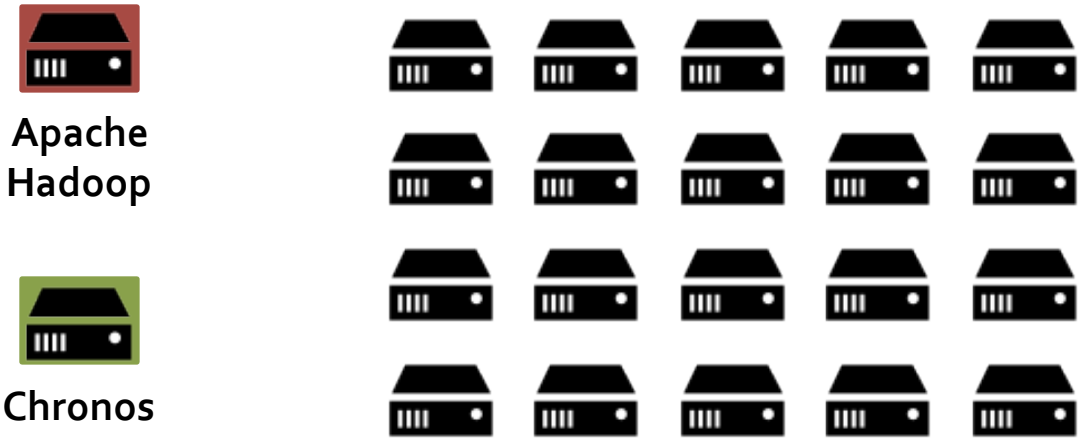
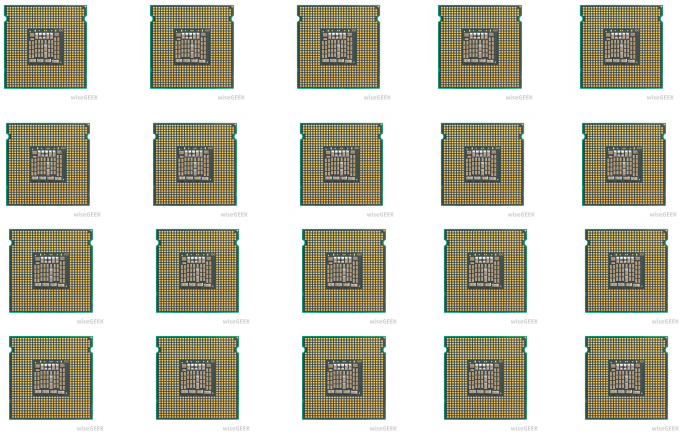
mesos – level of indirection



mesos – level of indirection

Apache Hadoop

Chronos



mesos – level of indirection

Apache
Hadoop

Chronos

a “kernel” for the datacenter

Apache
Hadoop

Chronos

primitives

scheduler – distributed system "master"

(***executor*** – lower-level control of task execution, optional)

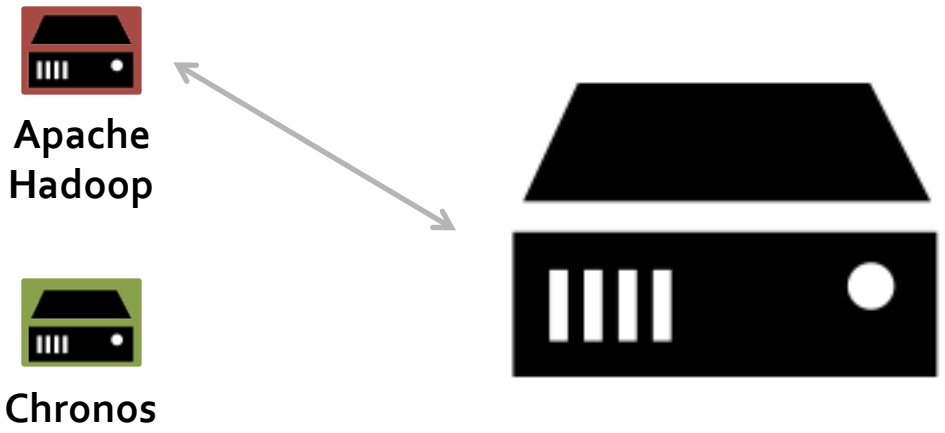
requests/offers – resource allocations

tasks – "threads" of the distributed system

state – working set of the distributed system

…

scheduler



scheduler

(1) brokers for resources (with master)

(2) launches tasks

(3) handles task termination

brokering for resources

(1) make resource ***requests***

2 CPUs

1 GB RAM

slave *

(2) respond to resource ***offers***

4 CPUs

4 GB RAM

slave foo.bar.com

offers: non-blocking resource allocation

exist to answer the question:

"*what should mesos do if it can't satisfy a request?"*

(1) wait until it can

(2) ***offer*** the best allocation it can immediately

offers: non-blocking resource allocation

exist to answer the question:

"*what should mesos do if it can't satisfy a request?*"

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“two-level scheduling”

mesos: controls resource allocations to schedulers

schedulers: make decisions about what to run given allocated resources

end-to-end principle

"application-specific functions ought to reside in the end hosts of a network rather than intermediary nodes"

tasks

either a concrete command line or an opaque description (which requires a framework executor to execute)

a *consumer* of resources

task operations

launching/killing

health monitoring/reporting (failure detection)

resource usage monitoring (statistics)

state (and replicated log)

… when your distributed system needs *state (*the "working set", often 10's to 100's of MB), what do you do?

- » a database is overkill (yet another system to manage)
- » ZooKeeper can work (but you probably want to use a higher level abstraction, and if you have more than 1MB you could be out of luck, and …)
- » can build your own distributed state machine …

state (and replicated log)

you probably don't want Paxos , you want Multi-Paxos

and Multi-Paxos is just a replicated log (i.e., a replicated log is an implementation of Multi-Paxos but with a nicer interface)

in Mesos since 0.9.0 (including Java/JNI bindings), used in production for ~2 years

state (and replicated log)

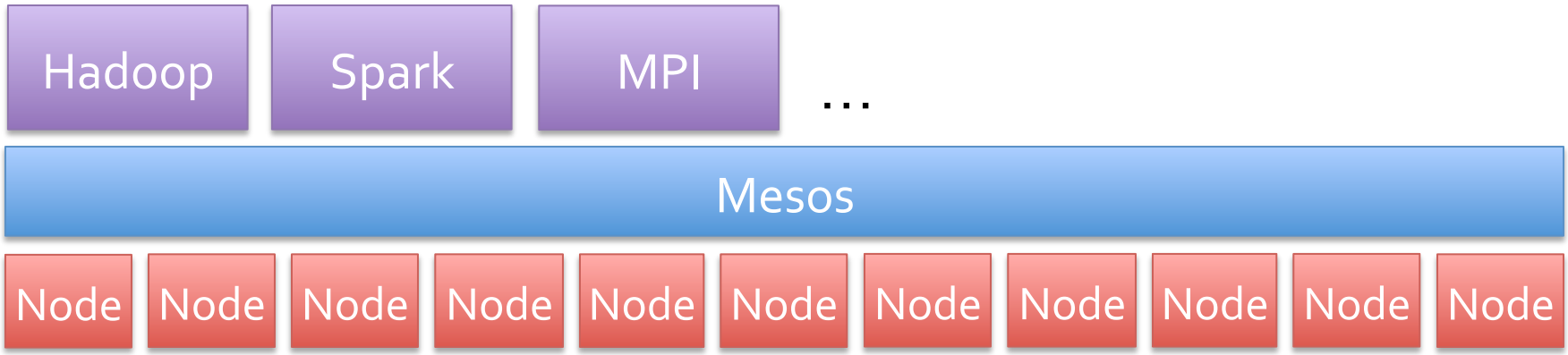
even a replicated log is fairly low-level (one of the reasons ZooKeeper is so popular) … enter "state"

```
State* state = new State(new ReplicatedLogStorage());
Future<Variable<Registry>> fetch = state->fetch("registry");
Variable<Registry> variable = fetch.get();
Registry registry = variable.get();

registry.makeSomeUpdates();

Variable<Registry> variable_ = variable.mutate(registry);
Future<Option<Variable<Registry>>> store = state->store(variable_);
```

Mesos


Hadoop
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MPI
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Mesos
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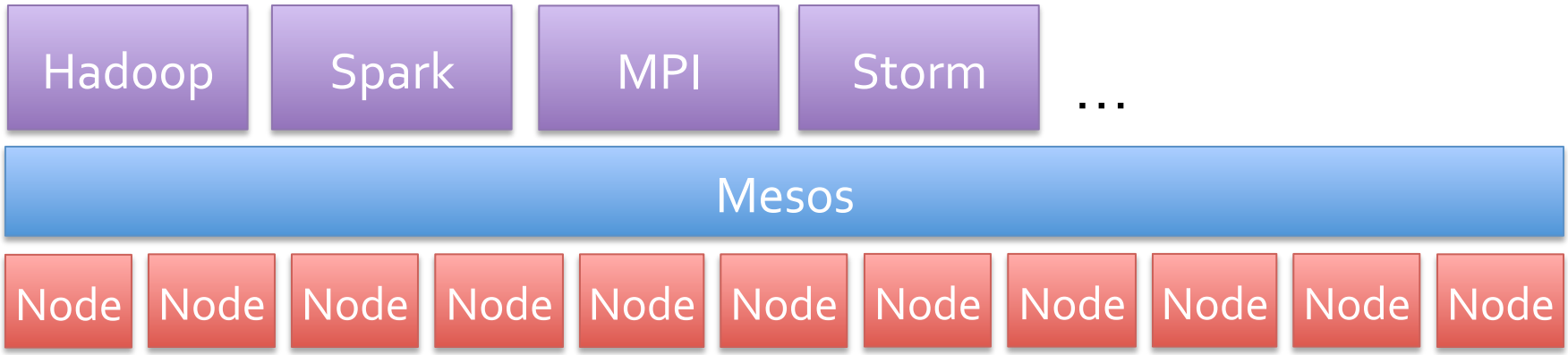
Mesos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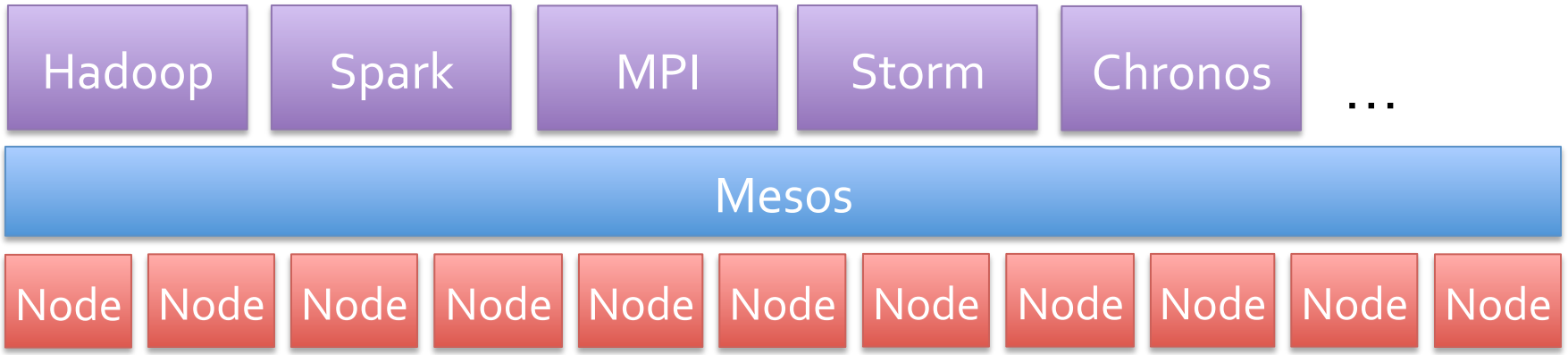
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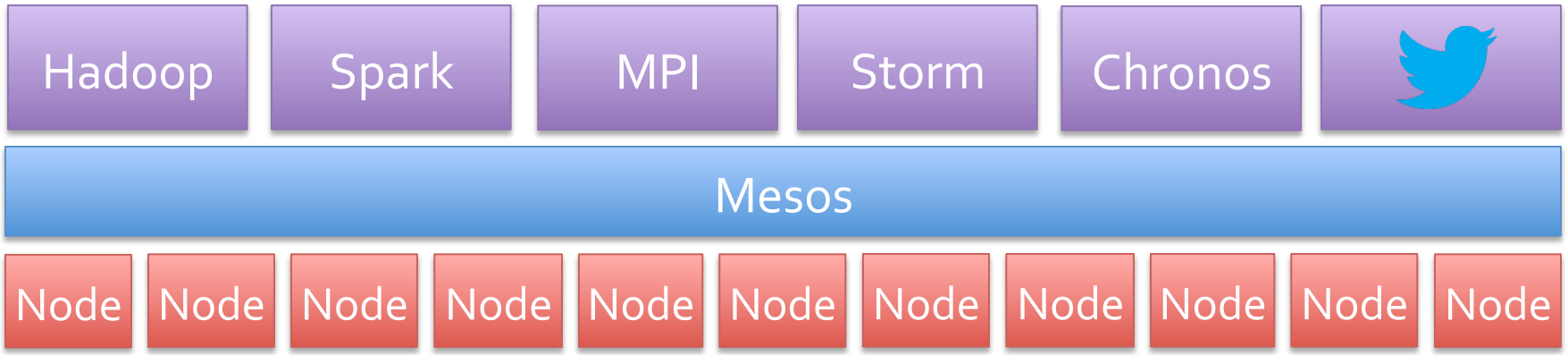
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Questions ...