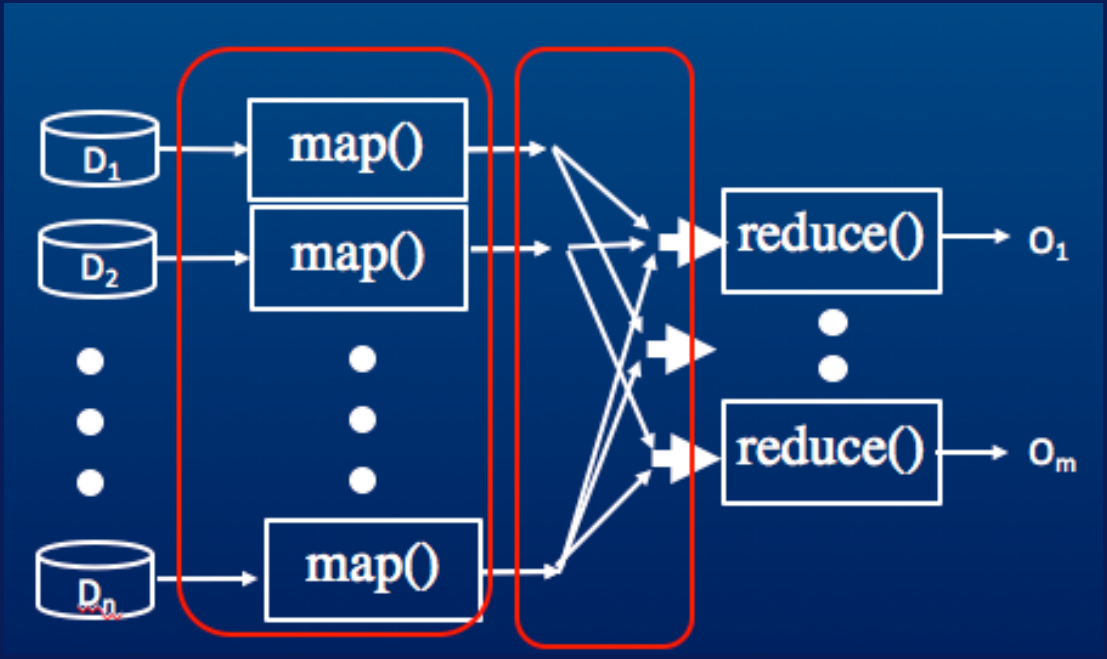
MapReduce Execution Framework

- ***Works for Applications that fit MapReduce paradigm.***



NextGen Execution Frameworks

- ***What if Application doesn't fit or is not efficient in MapReduce Paradigm?***

NextGen Execution Frameworks

- ***What if Application doesn't fit or is not efficient in MapReduce Paradigm?***
  - *Interactive data exploration*
  - *Iterative data processing*

NextGen Execution Frameworks

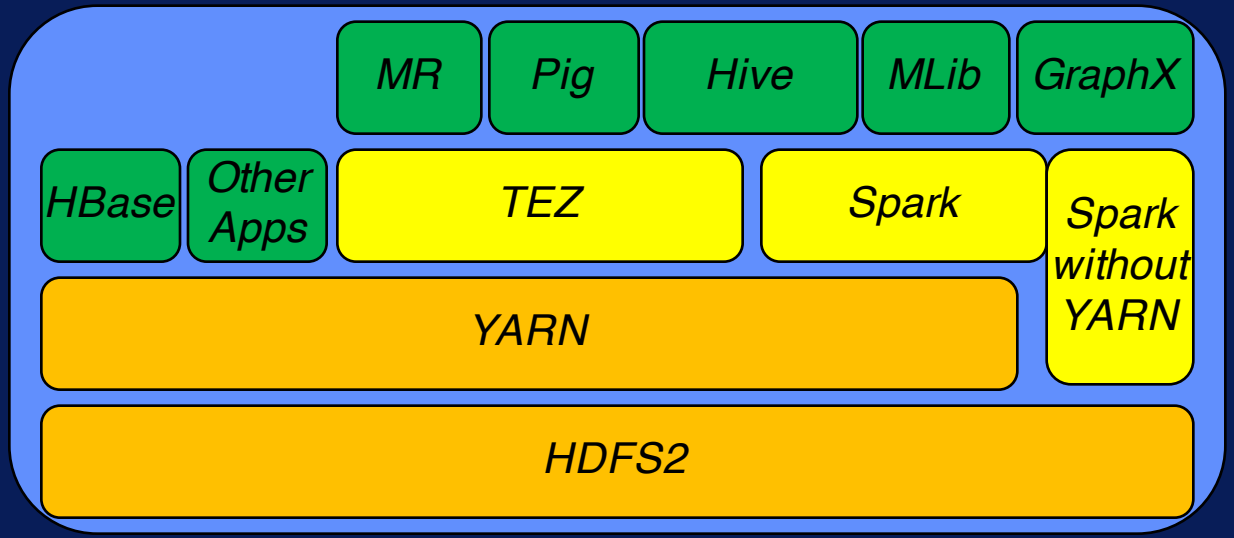
- *Enter: Execution frameworks like YARN, Tez, Spark*
- ***Support complex directed acyclic graph (DAG) of tasks.***
- ***In memory caching of data***

Hadoop Execution Environment

- *Layout of new frameworks (YARN, Tez, Spark) in Hadoop environment.*
- *Optimization strategies used in new frameworks.*
- *Examples illustrating use of Tez, Spark.*

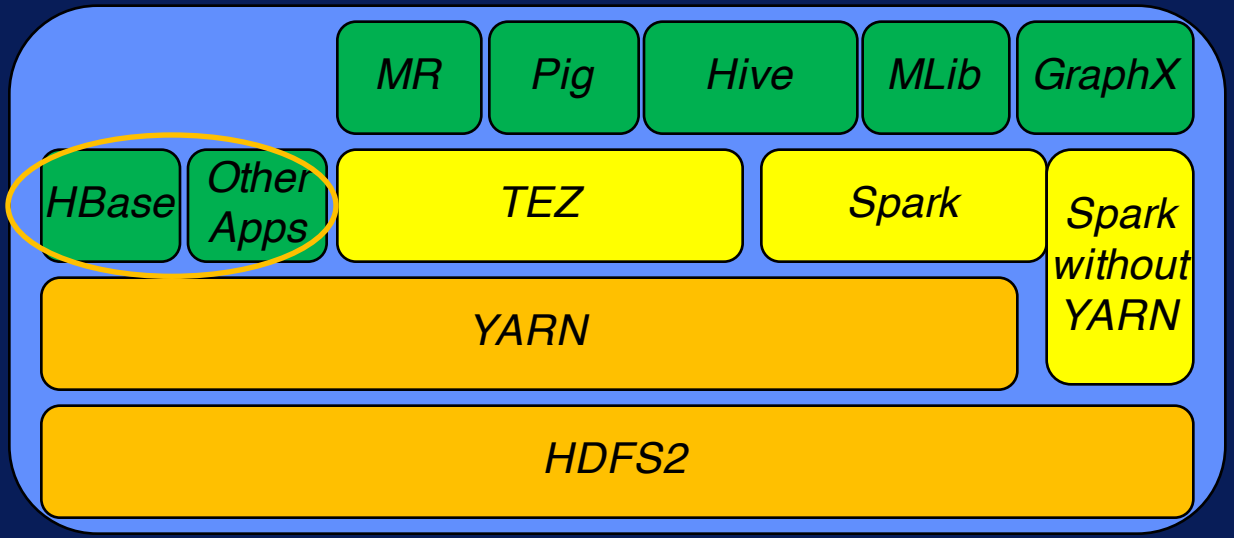
YARN, Tez, Spark

- **Execution frameworks: YARN, Tez, and Spark**



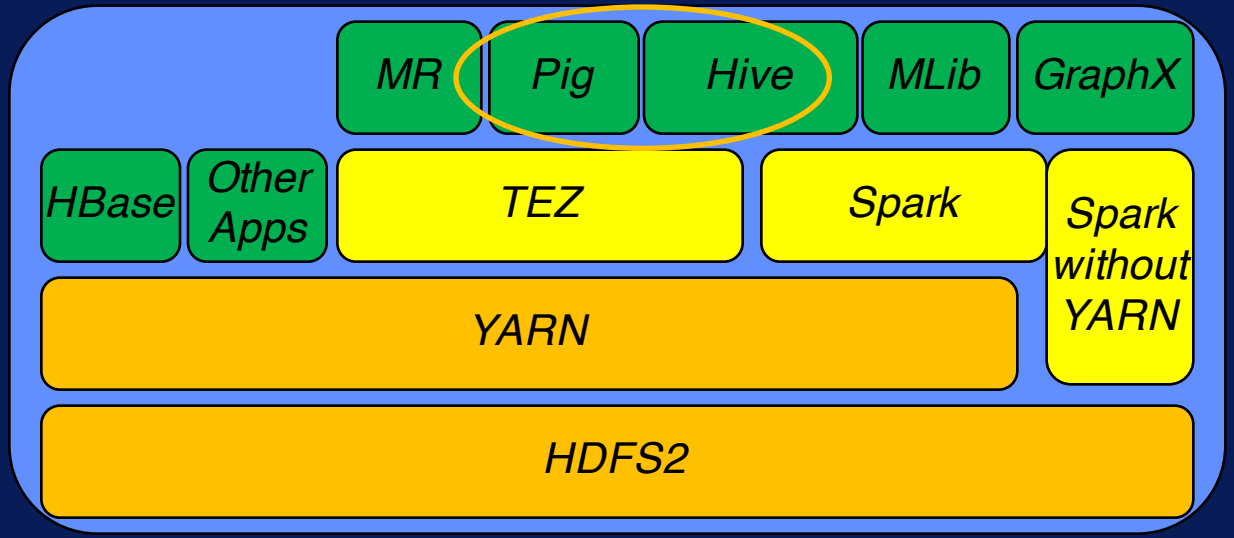
YARN, Tez, Spark

- **Execution frameworks: YARN, Tez, and Spark**



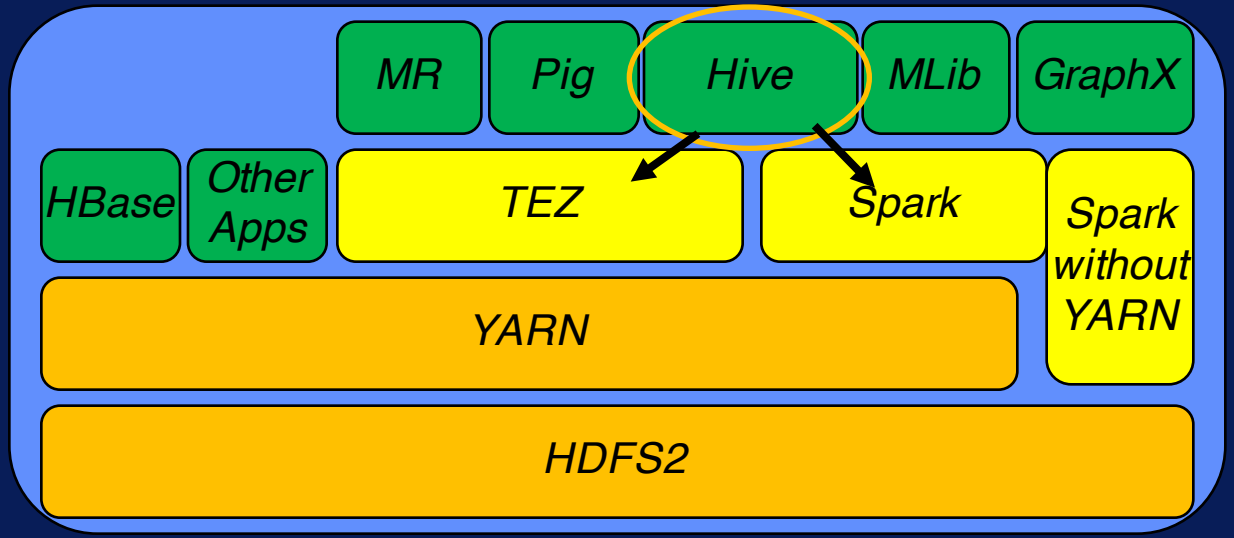
YARN, Tez, Spark

- **Execution frameworks: YARN, Tez, and Spark**



YARN, Tez, Spark

- **Execution frameworks: YARN, Tez, and Spark**



YARN

- *MapReduce*
- *Open source/commercial applications*
- *User developed applications*
- *Frameworks like Tez, Spark*

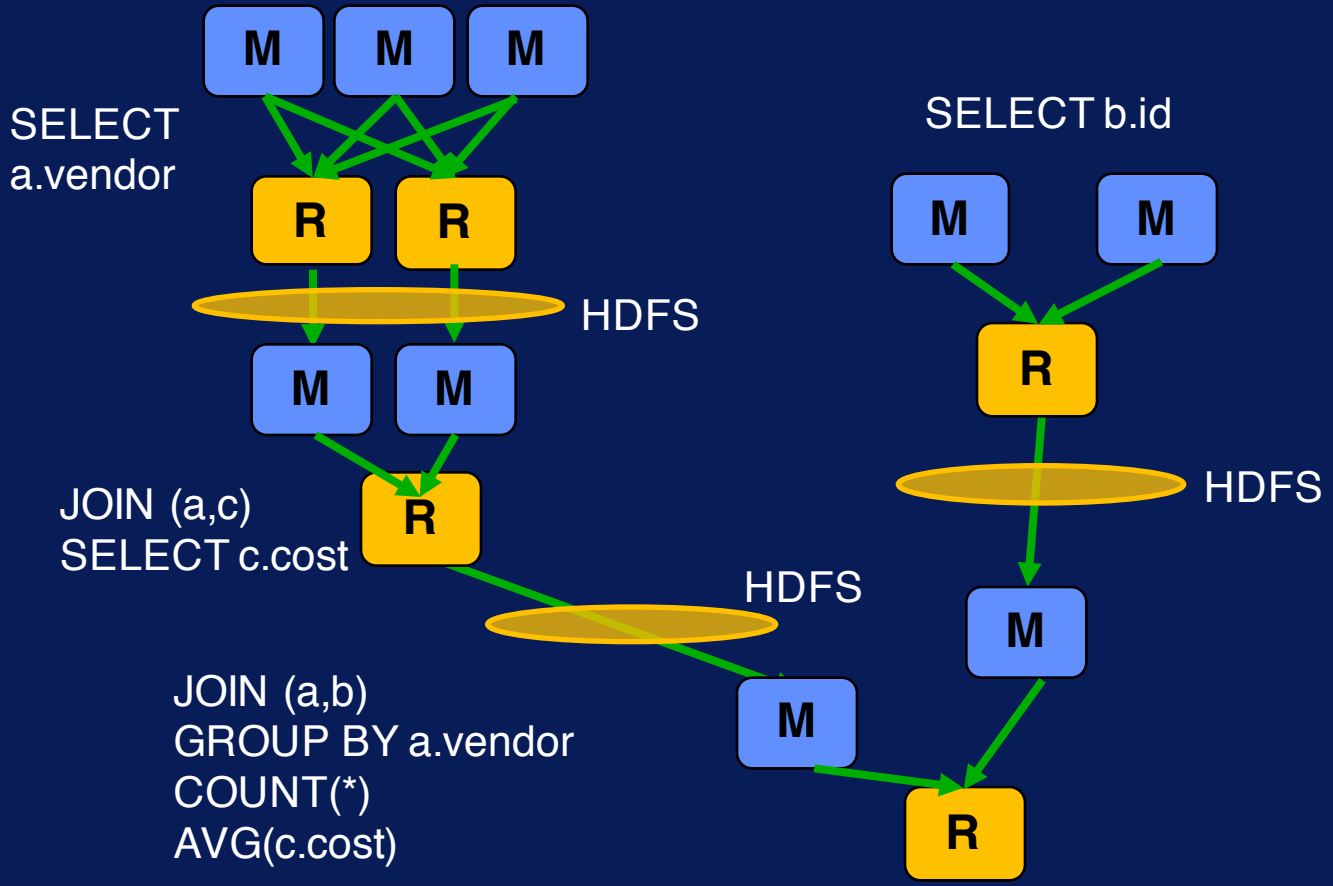
Tez

- *Dataflow graphs*
- *Custom data types*
- *Can run complex DAG of tasks*
- *Dynamic DAG changes*
- *Resource usage efficiency*

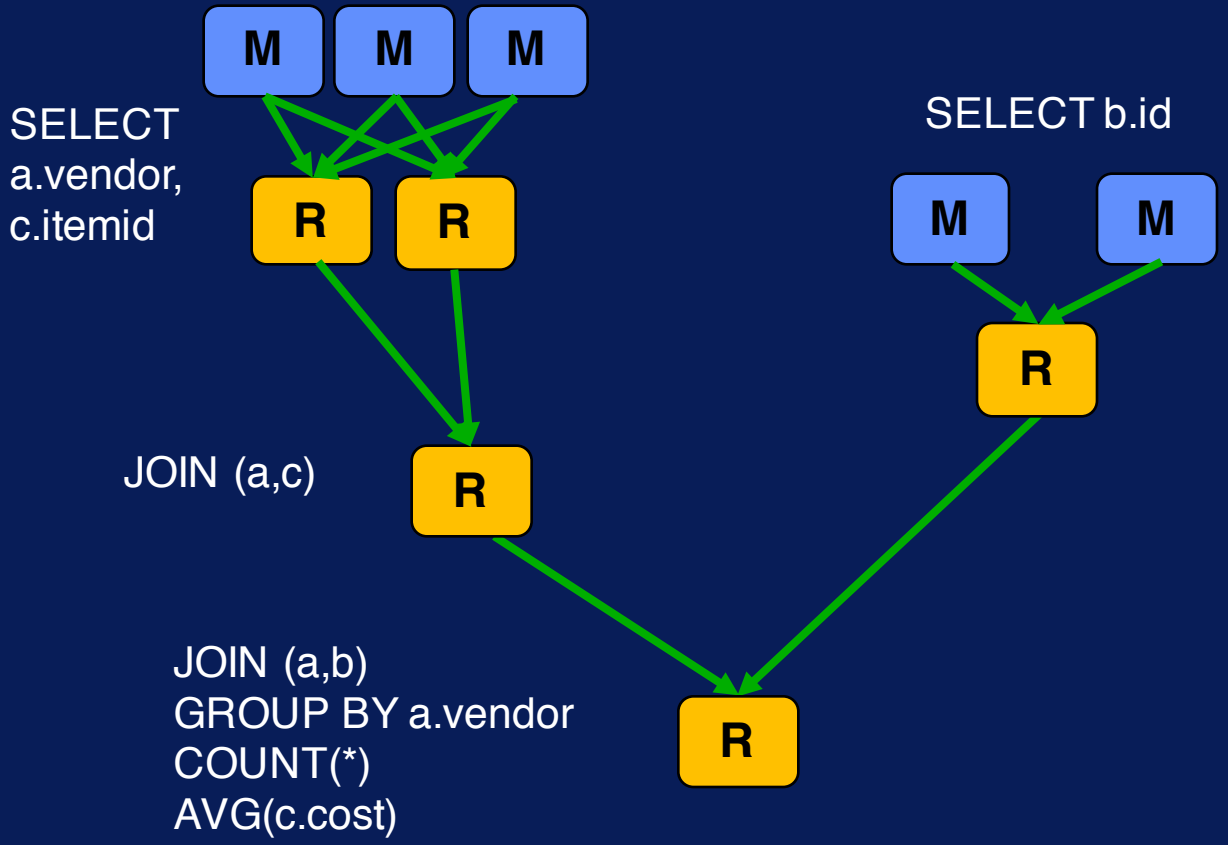
HIVE on Tez example

```
SELECT a.vendor, COUNT(*), AVG(c.cost) FROM a
JOIN b ON (a.id = b.id)
JOIN c ON (a.itemid = c.itemid)
GROUP BY a.vendor
```

HIVE Example - MapReduce



HIVE Example - Tez



Spark

- *Advanced DAG execution engine*
- *Supports cyclic data flow*
- *In-memory computing*
- *Java, Scala, Python, R*
- *Existing optimized libraries*

Spark Example

- Logistic Regression example

```
points = spark.textFile(...).map(parsePoint).cache()
w = numpy.random.ranf(size = D) # current separating plane
for i in range(ITERATIONS):
    gradient = points.map(
        lambda p: (1 / (1 + exp(-p.y*(w.dot(p.x)))) - 1) * p.y * p.x
    ).reduce(lambda a, b: a + b)
    w -= gradient
print "Final separating plane: %s" % w
```

Spark Example

- Logistic Regression example

```
points = spark.textFile(...).map(parsePoint).cache()
w = numpy.random.ranf(size = D) # current separating plane
for i in range(ITERATIONS):
    gradient = points.map(
        lambda p: (1 / (1 + exp(-p.y*(w.dot(p.x)))) - 1) * p.y * p.x
    ).reduce(lambda a, b: a + b)
    w -= gradient
print "Final separating plane: %s" % w
```

Hadoop Resource Scheduling

- *Learn about resource management*
- *Different kinds of scheduling algorithms*
- *Types of parameters that can be controlled*.

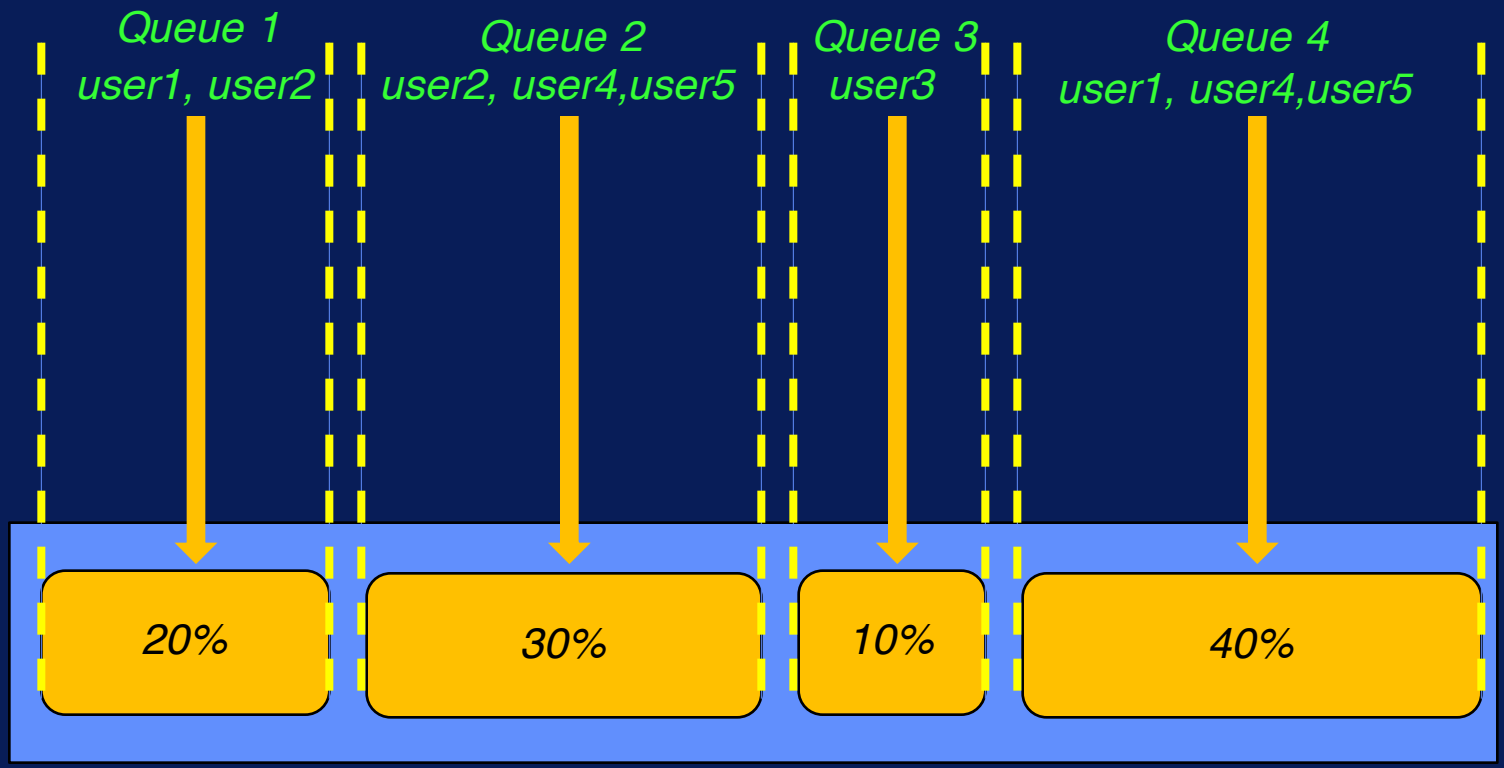
Motivation for Schedulers

- ***Various execution engines/options***
- ***Scheduling, Performance***
- ***Control of resources between components***

Schedulers

- ***Default – First in First out (FIFO)***
- ***Fairshare***
- ***Capacity***

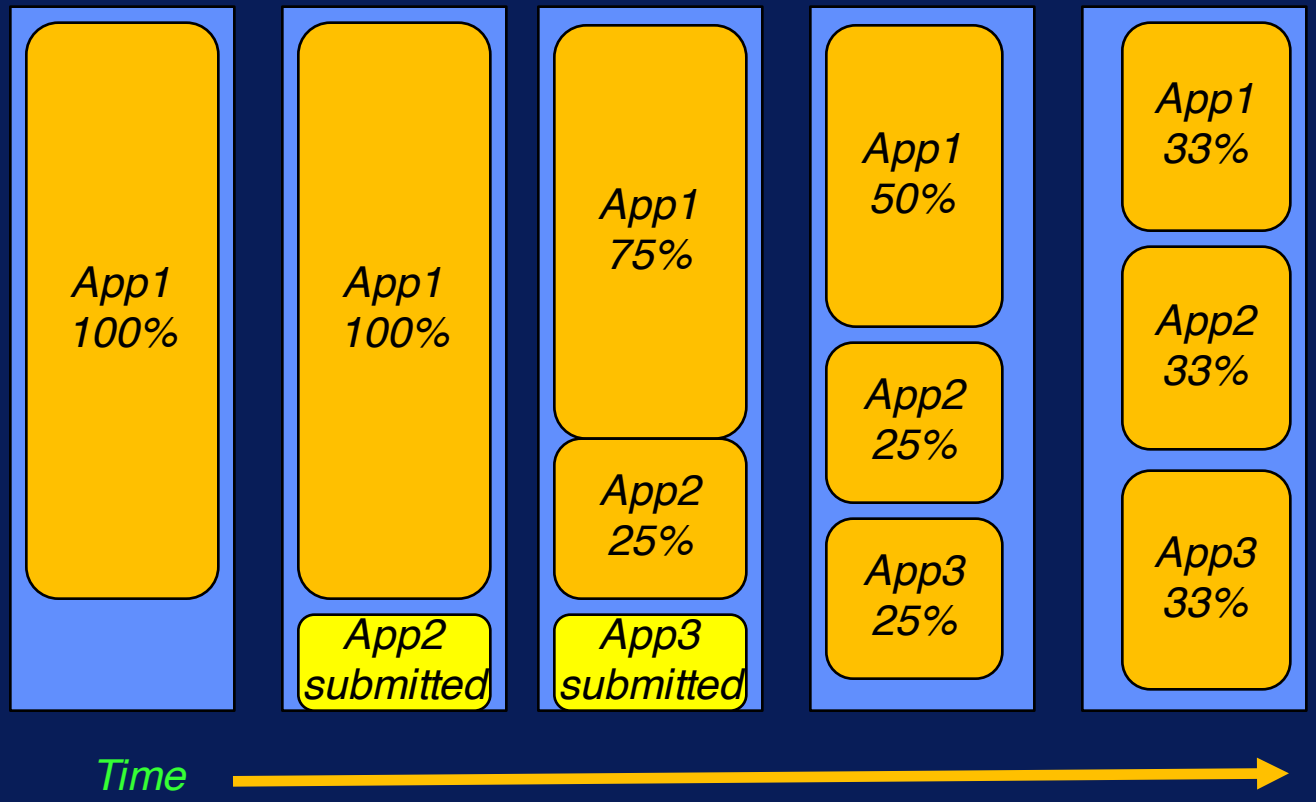
Capacity Scheduler



Capacity Scheduler

- *Queues and sub-queues*
- *Capacity Guarantee with elasticity*
- *ACLs for security*
- *Runtime changes/draining apps*
- *Resource based scheduling*

Fairshare Scheduler



Fairshare Scheduler

- *Balances out resource allocation among apps over time.*
- *Can organize into queues/sub-queues*
- *Guarantee minimum shares*
- *Limits per user/app*
- *Weighted app priorities*

Summary of resource scheduling

- *Default is FIFO*
- *Fairshare and Capacity schedulers*
- *Queues/sub-queues possible*
- *User/App based limits*
- *Resource limits*
- *Vendors usually provide additional mechanisms to allocate resources*