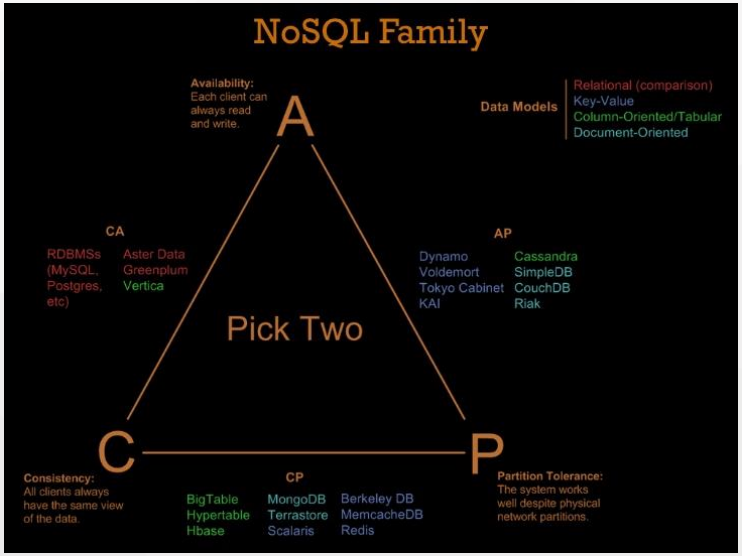
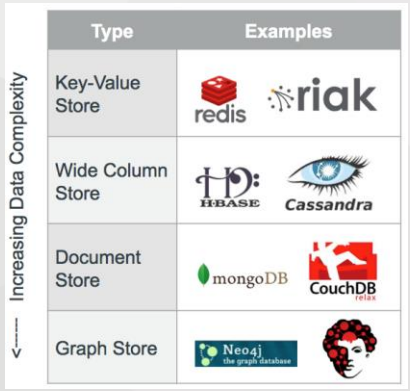


The Pilot Of HBase

2017.3 XenRon

CONTENTS



Review

Review

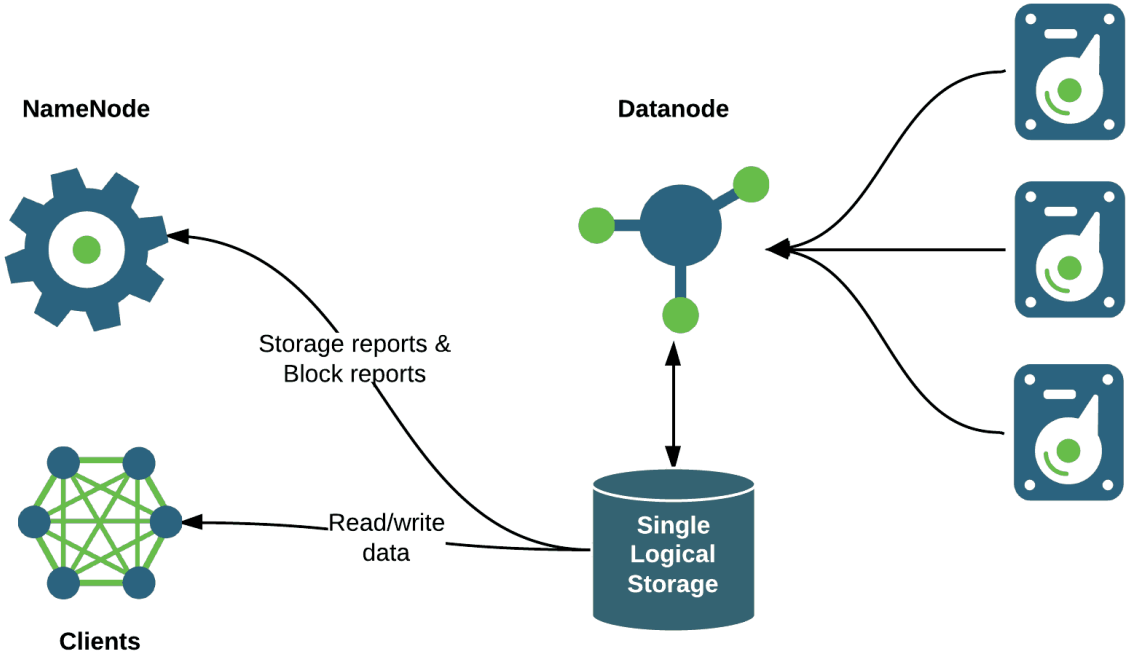
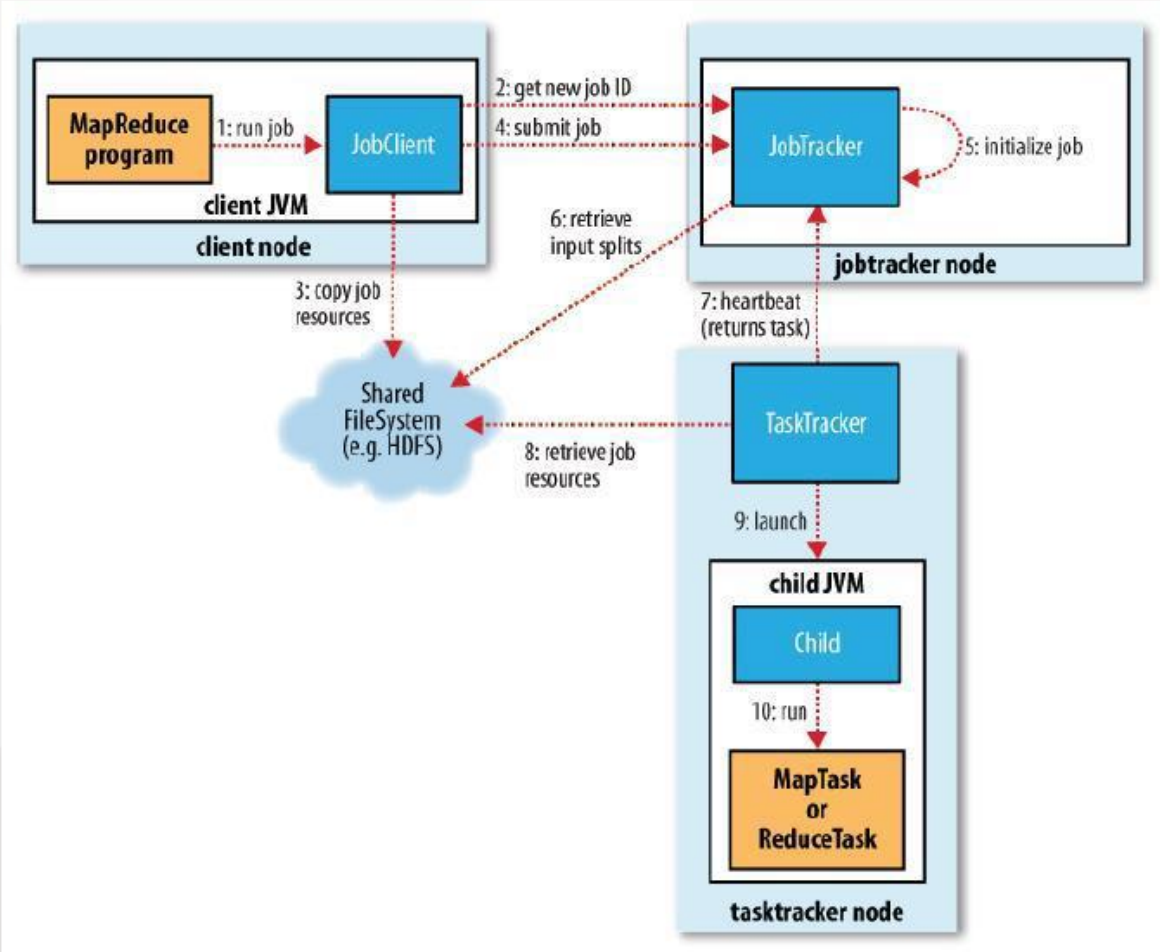


Figure 1: A DataNode presented itself as a single logical storage

Review


MapReduce program
1: run job
JobClient
client JVM
client node
2: get new job ID
4: submit job
JobTracker
5: initialize job
jobtracker node
6: retrieve input splits
3: copy job resources
7: heartbeat (returns task)
Shared FileSystem (e.g. HDFS)
8: retrieve job resources
TaskTracker
9: launch
child JVM
Child
10: run
MapTask or ReduceTask
tasktracker node

迭代式 MapReduce
依赖关系组合式 MapReduce
链式 MapReduce

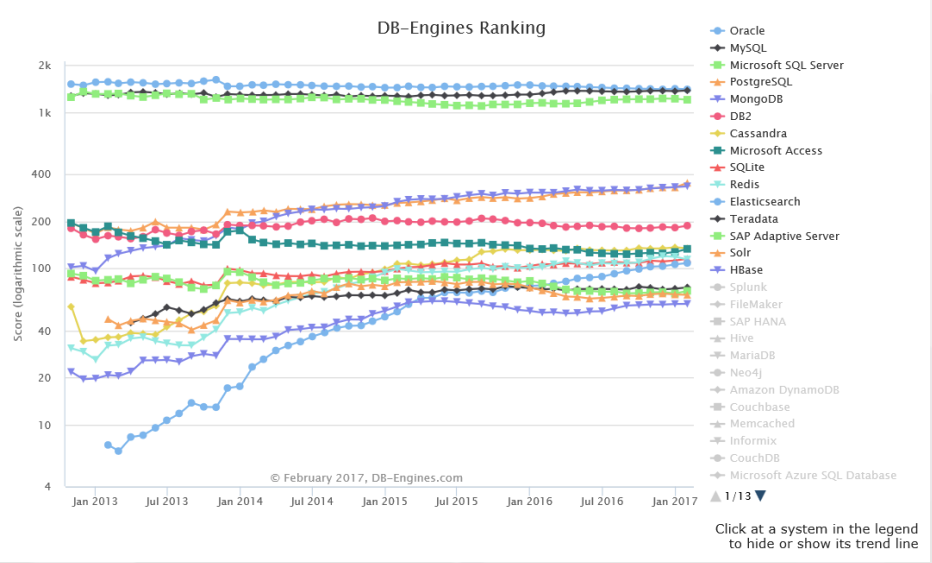
http://www.cnblogs.com/liqizhou/archive/2012/05/14/2499653.html

NoSQL

DB-Engines Ranking

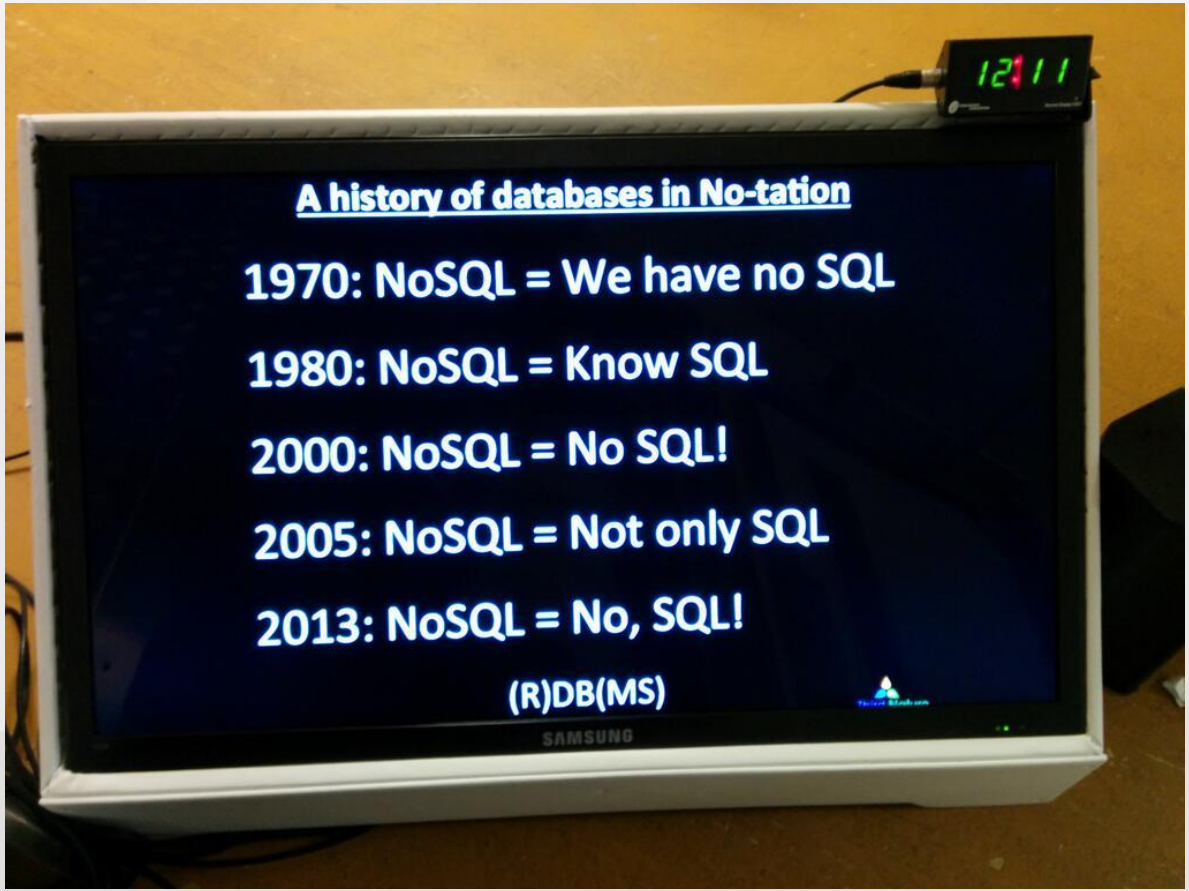
318 systems in ranking, February 2017

Rank Feb 2017	Rank Jan 2017	Rank Feb 2016	DBMS	Database Model	Score Feb 2017	Score Jan 2017	Score Feb 2016
1.	1.	1.	Oracle	Relational DBMS	1403.83	-12.89	-72.31
2.	2.	2.	MySQL	Relational DBMS	1380.30	+14.02	+59.18
3.	3.	3.	Microsoft SQL Server	Relational DBMS	1203.45	-17.50	+53.23
4.	↑ 5.	↑ 5.	PostgreSQL	Relational DBMS	353.68	+23.31	+65.02
5.	↓ 4.	↓ 4.	MongoDB	Document store	335.50	+3.60	+29.90
6.	6.	6.	DB2	Relational DBMS	187.90	+5.41	-6.58
7.	7.	↑ 8.	Cassandra	Wide column store	134.38	-2.06	+2.62
8.	8.	↓ 7.	Microsoft Access	Relational DBMS	133.39	+5.94	+0.31
9.	↑ 10.	9.	SQLite	Relational DBMS	115.31	+2.93	+8.53
10.	↓ 9.	10.	Redis	Key-value store	114.03	-4.66	+11.96
11.	11.	↑ 12.	Elasticsearch	Search engine	108.31	+2.14	+30.47
12.	12.	↑ 13.	Teradata	Relational DBMS	75.60	+1.43	+2.22
13.	13.	↓ 11.	SAP Adaptive Server	Relational DBMS	71.74	+2.63	-8.30
14.	14.	14.	Solr	Search engine	67.69	-0.39	-4.59
15.	15.	↑ 16.	HBase	Wide column store	59.24	+0.10	+7.22
16.	16.	↑ 18.	Splunk	Search engine	56.03	+0.54	+13.20
17.	17.	17.	FileMaker	Relational DBMS	55.19	+1.71	+8.16
18.	18.	↑ 19.	SAP HANA	Relational DBMS	52.45	+0.52	+14.37
19.	19.	↓ 15.	Hive	Relational DBMS	47.95	-3.19	-4.83
20.	20.	↑ 23.	MariaDB	Relational DBMS	45.35	+0.31	+16.57
21.	21.	21.	Neo4j	Graph DBMS	36.27	+0.00	+3.98
22.	22.	↑ 26.	Amazon DynamoDB	Document store	32.19	+1.16	+10.39
23.	23.	↑ 24.	Couchbase	Document store	31.18	+0.96	+5.79
24.	24.	↓ 22.	Memcached	Key-value store	30.53	+2.09	+1.60
25.	25.	↓ 20.	Informix	Relational DBMS	27.25	+0.82	-5.76

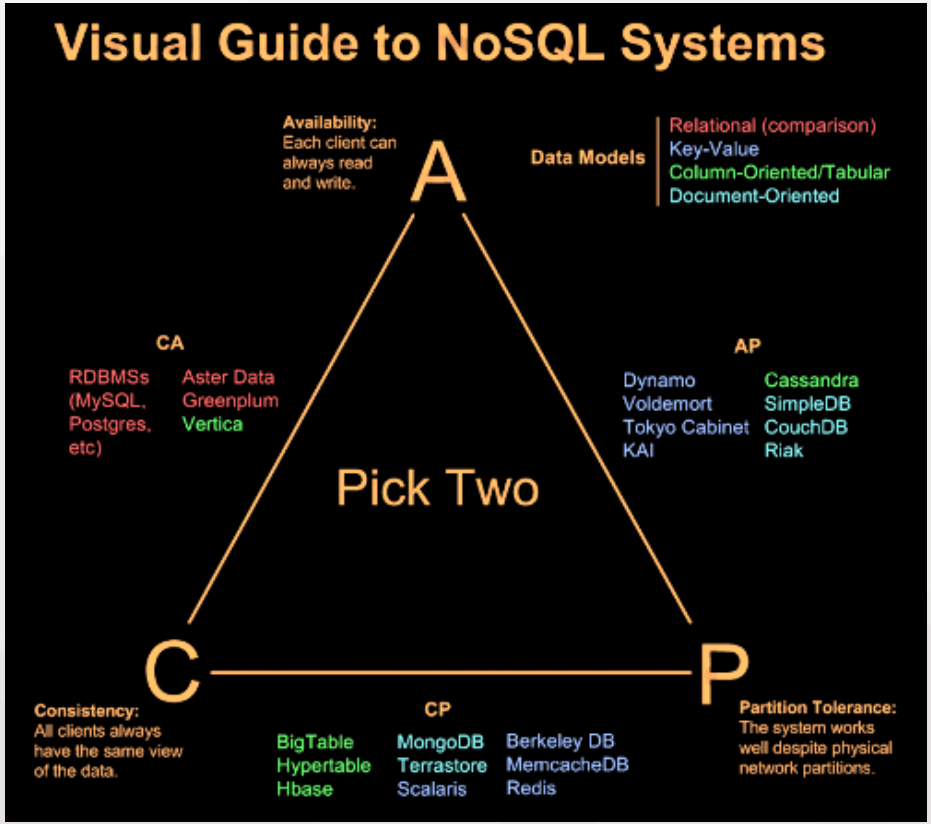


http://db-engines.com/en/ranking
http://db-engines.com/en/ranking_trend

The History of SQL



CAP Theorem



Professor Eric A. Brewer
University of California at Berkeley

Cassandra

Cassandra Write Data Flows

Single Region, Multiple Availability Zone

1. Client Writes to any Cassandra Node
2. Coordinator Node replicates to nodes and Zones
3. Nodes return ack to coordinator
4. Coordinator returns ack to client
5. Data written to internal commit log disk

If a node goes offline, hinted handoff completes the write when the node comes back up.

Requests can choose to wait for one node, a quorum, or all nodes to ack the write

SSTable disk writes and compactions occur asynchronously

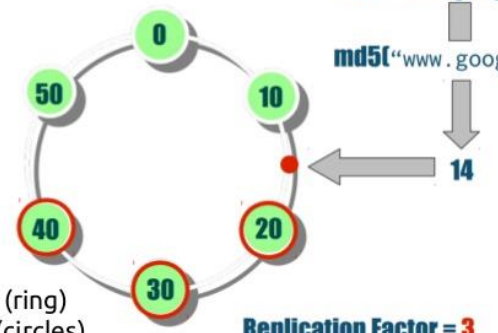
NETFLIX

Architecture

Partitioner:
Consistent Hashing

Key: "www.google.com"

md5("www.google.com")



Replication Factor = 3

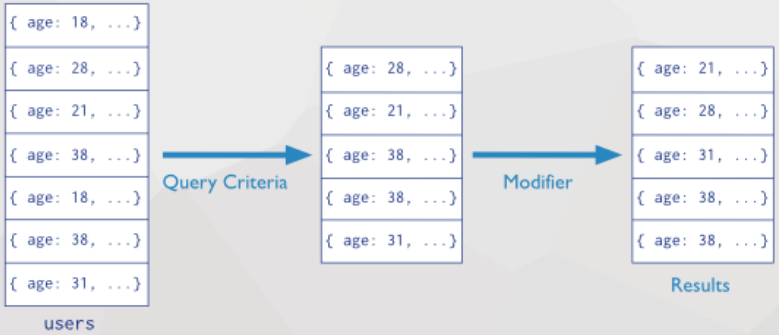
- Cluster (ring)
- Nodes (circles)
- Peer-to-Peer Model
- Gossip Protocol

mongoDB Official Website : https://www.mongodb.org/
The latest stable Release : v3.0.4

```
{
  name: "sue",                    <-- field: value
  age: 26,                        <-- field: value
  status: "A",                    <-- field: value
  groups: [ "news", "sports" ]    <-- field: value
}
```

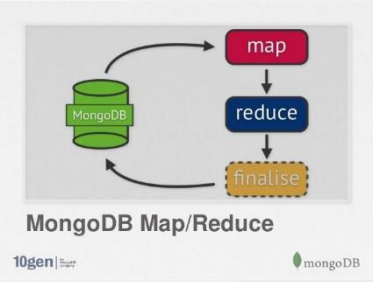
Collection | Query Criteria | Modifier

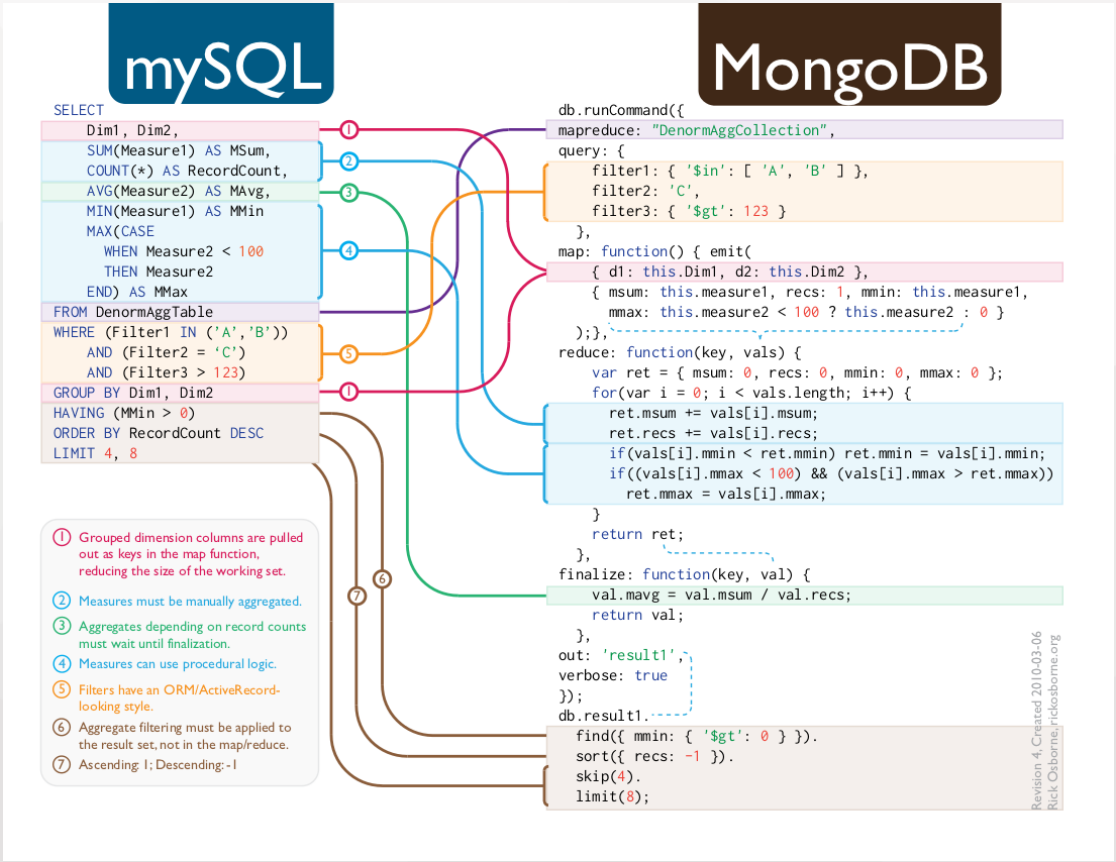
```
db.users.find( { age: { $gt: 18 } } ).sort( {age: 1 } )
```



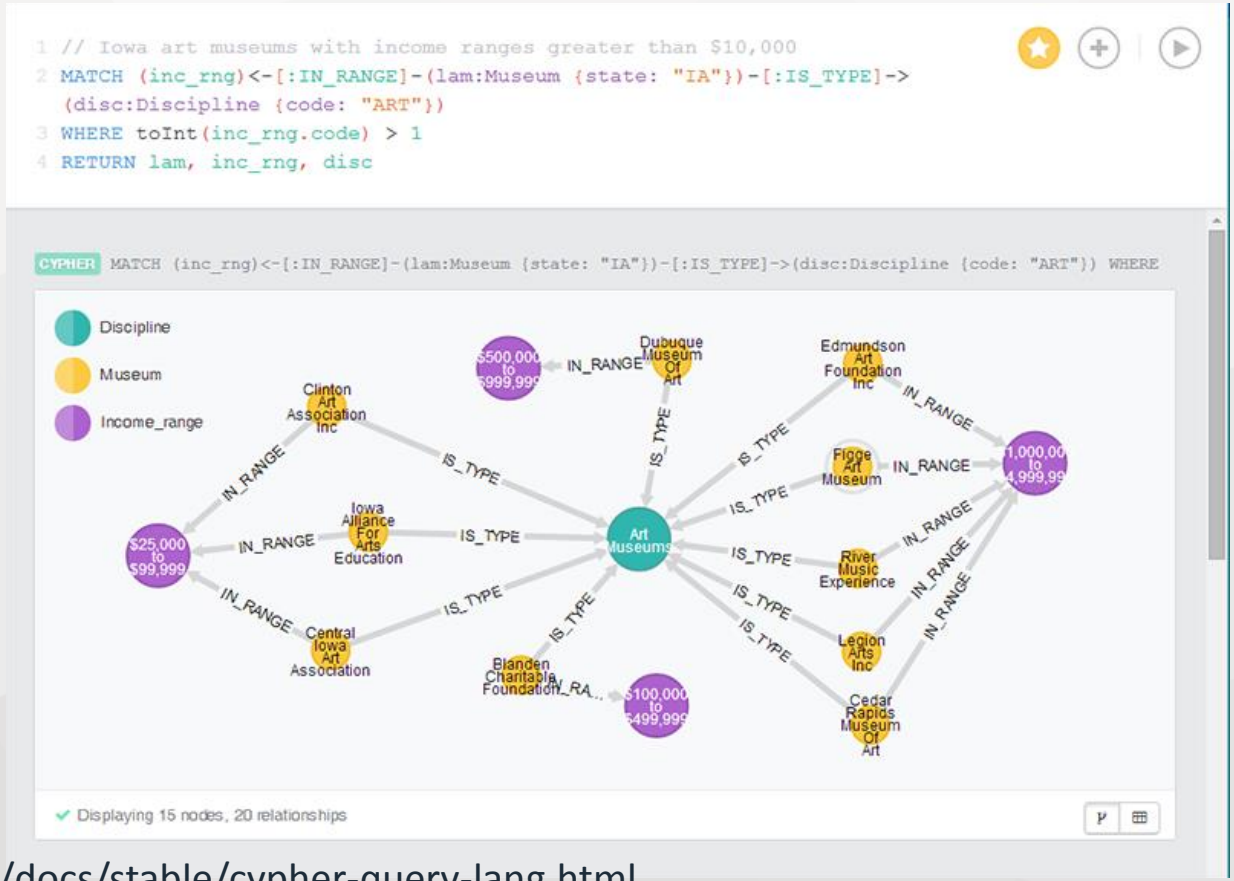

```
db.users.insert (                 <-- collection
   {
     name: "sue",                 <-- field: value
     age: 26,                     <-- field: value
     status: "A"                  <-- field: value
   }                              } document
)
db.users.update(                  <-- collection
   { age: { $gt: 18 } },          <-- update criteria
   { $set: { status: "A" } },     <-- update action
   { multi: true }                <-- update option
)

db.users.remove(                  <-- collection
   { status: "D" }                <-- remove criteria
)
```

MongoDB


map
reduce
finalise
MongoDB
MongoDB Map/Reduce
10gen
mongoDB


mySQL
MongoDB
SELECT
Dim1, Dim2,
SUM(Measure1) AS MSum,
COUNT(*) AS RecordCount,
AVG(Measure2) AS MAvg,
MIN(Measure1) AS MMin
MAX(CASE
WHEN Measure2 < 100
THEN Measure2
END) AS MMax
FROM DenormAggTable
WHERE (Filter1 IN ('A','B'))
AND (Filter2 = 'C')
AND (Filter3 > 123)
GROUP BY Dim1, Dim2
HAVING (MMin > 0)
ORDER BY RecordCount DESC
LIMIT 4, 8
db.runCommand({
mapreduce: "DenormAggCollection",
query: {
filter1: { '$in': ['A', 'B'] },
filter2: 'C',
filter3: { '$gt': 123 }
},
map: function() { emit(
{ d1: this.Dim1, d2: this.Dim2 },
{ msum: this.measure1, recs: 1, mmin: this.measure1,
mmax: this.measure2 < 100 ? this.measure2 : 0 }
);},
reduce: function(key, vals) {
var ret = { msum: 0, recs: 0, mmin: 0, mmax: 0 };
for(var i = 0; i < vals.length; i++) {
ret.msum += vals[i].msum;
ret.recs += vals[i].recs;
if(vals[i].mmin < ret.mmin) ret.mmin = vals[i].mmin;
if((vals[i].mmax < 100) && (vals[i].mmax > ret.mmax))
ret.mmax = vals[i].mmax;
}
return ret;
},
finalize: function(key, val) {
val.mavg = val.msum / val.recs;
return val;
},
out: 'result1',
verbose: true
});
db.result1.
find({ mmin: { '$gt': 0 } }).
sort({ recs: -1 }).
skip(4).
limit(8);
1 Grouped dimension columns are pulled out as keys in the map function, reducing the size of the working set.
2 Measures must be manually aggregated.
3 Aggregates depending on record counts must wait until finalization.
4 Measures can use procedural logic.
5 Filters have an ORM/ActiveRecord-looking style.
6 Aggregate filtering must be applied to the result set, not in the map/reduce.
7 Ascending: 1; Descending: -1
Revision 4. Created 2010-03-06
Rick Osborne, rickosborne.org

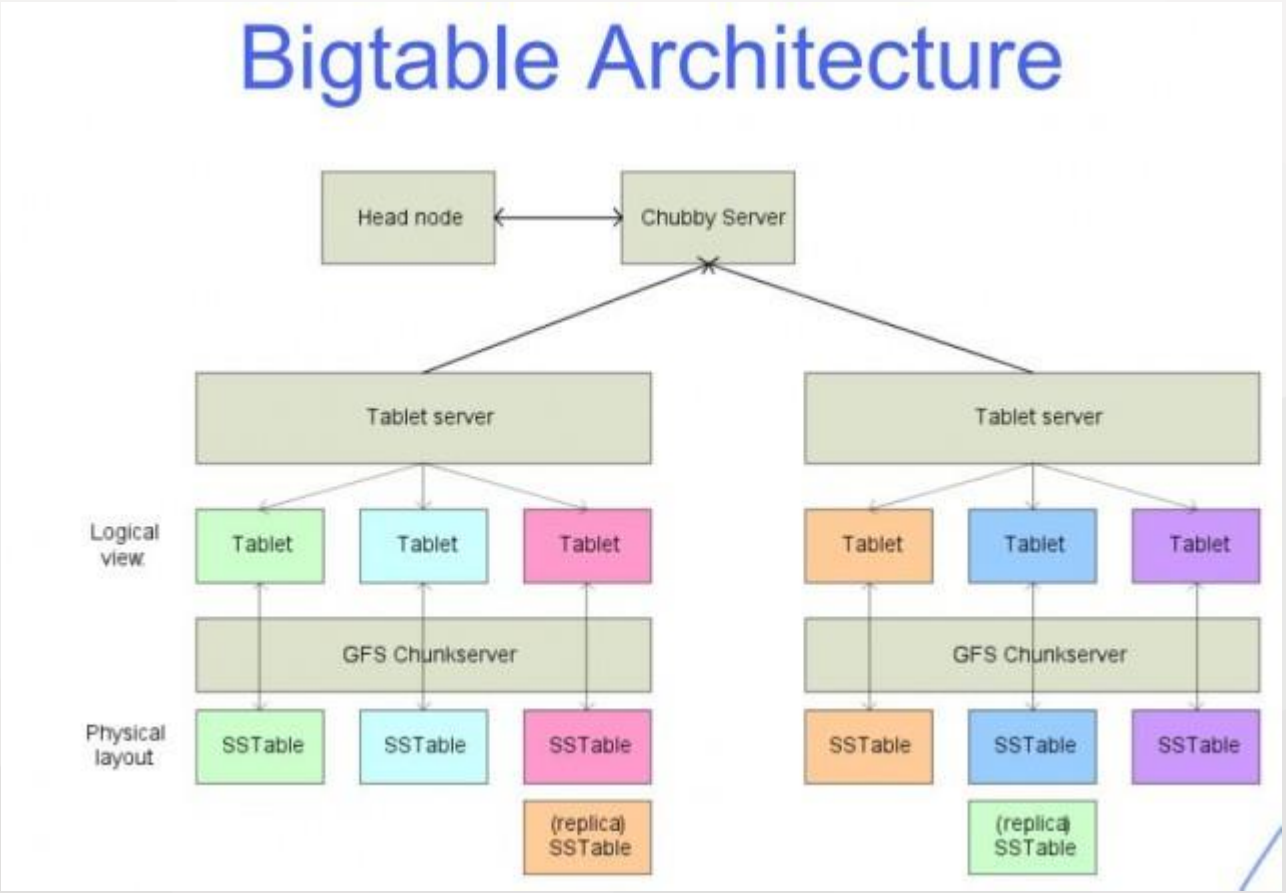
```
1 // Iowa art museums with income ranges greater than $10,000
2 MATCH (inc_rng)<-[:IN_RANGE]-(lam:Museum {state: "IA"})-[:IS_TYPE]->
  (disc:Discipline {code: "ART"})
3 WHERE toInt(inc_rng.code) > 1
4 RETURN lam, inc_rng, disc
```



http://neo4j.com/docs/stable/cypher-query-lang.html

Hbase Origin

BigTable



https://research.google.com/archive/bigtable.html

Java SE Public Updates

Major Release	GA Date	End of Public Updates Notification	End of Public Updates
5.0	May 2004	Apr 2008	Oct 2009
6	Dec 2006	Feb 2011	Feb 2013
7	Jul 2011	Mar 2014	Apr 2015
8	Mar 2014	TBD	Sep 2017*

* or later, depending on factors described above.

http://www.oracle.com/technetwork/java/eol-135779.html

HBase Versions

Hadoop version support matrix

- "S" = supported
- "X" = not supported
- "NT" = Not tested

	HBase-0.94.x	HBase-0.98.x (Support for Hadoop 1.1+ is deprecated.)	HBase-1.0.x (Hadoop 1.x is NOT supported)	HBase-1.1.x	HBase-1.2.x	HBase-1.3.x	HBase-2.0.x
Hadoop-1.0.x	X	X	X	X	X	X	X
Hadoop-1.1.x	S	NT	X	X	X	X	X
Hadoop-0.23.x	S	X	X	X	X	X	X
Hadoop-2.0.x-alpha	NT	X	X	X	X	X	X
Hadoop-2.1.0-beta	NT	X	X	X	X	X	X
Hadoop-2.2.0	NT	S	NT	NT	X	X	X
Hadoop-2.3.x	NT	S	NT	NT	X	X	X
Hadoop-2.4.x	NT	S	S	S	S	S	X
Hadoop-2.5.x	NT	S	S	S	S	S	X
Hadoop-2.6.0	X	X	X	X	X	X	X
Hadoop-2.6.1+	NT	NT	NT	NT	S	S	S
Hadoop-2.7.0	X	X	X	X	X	X	X
Hadoop-2.7.1+	NT	NT	NT	NT	S	S	S

https://hbase.apache.org/book.html#hadoop

HBase Versions

§ 4. Basic Prerequisites

This section lists required services and some required system configuration.

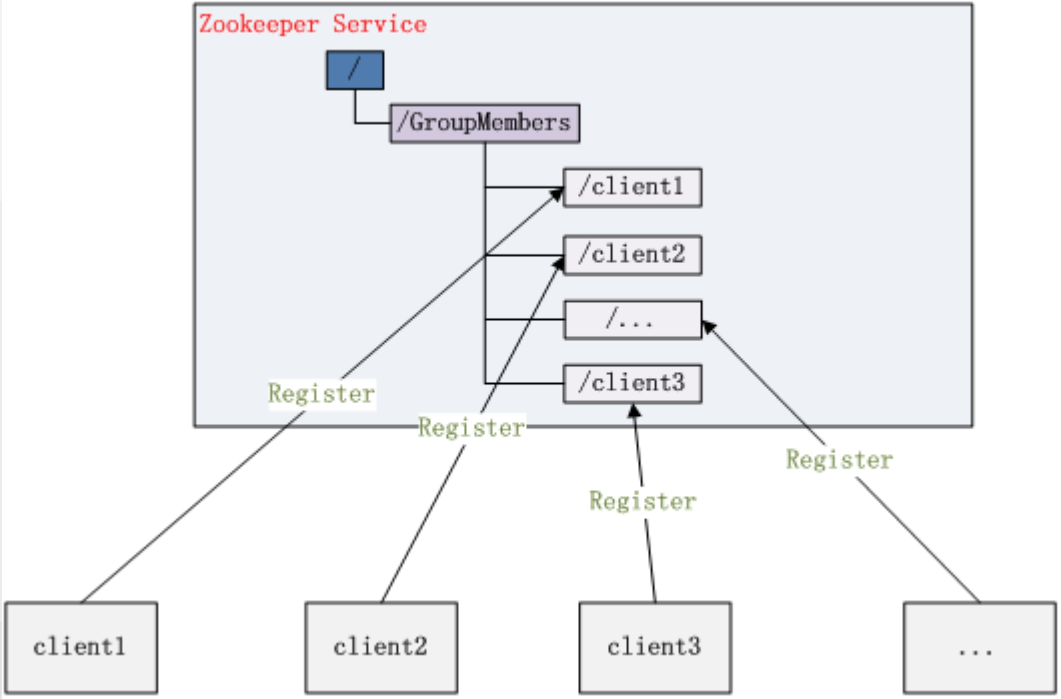
Table 2. Java

HBase Version	JDK 6	JDK 7	JDK 8
2.0	Not Supported	Not Supported	yes
1.3	Not Supported	yes	yes
1.2	Not Supported	yes	yes
1.1	Not Supported	yes	Running with JDK 8 will work but is not well tested.
1.0	Not Supported	yes	Running with JDK 8 will work but is not well tested.
0.98	yes	yes	Running with JDK 8 works but is not well tested. Building with JDK 8 would require removal of the deprecated `remove()` method of the `PoolMap` class and is under consideration. See HBASE-7608 for more information about JDK 8 support.
0.94	yes	yes	N/A

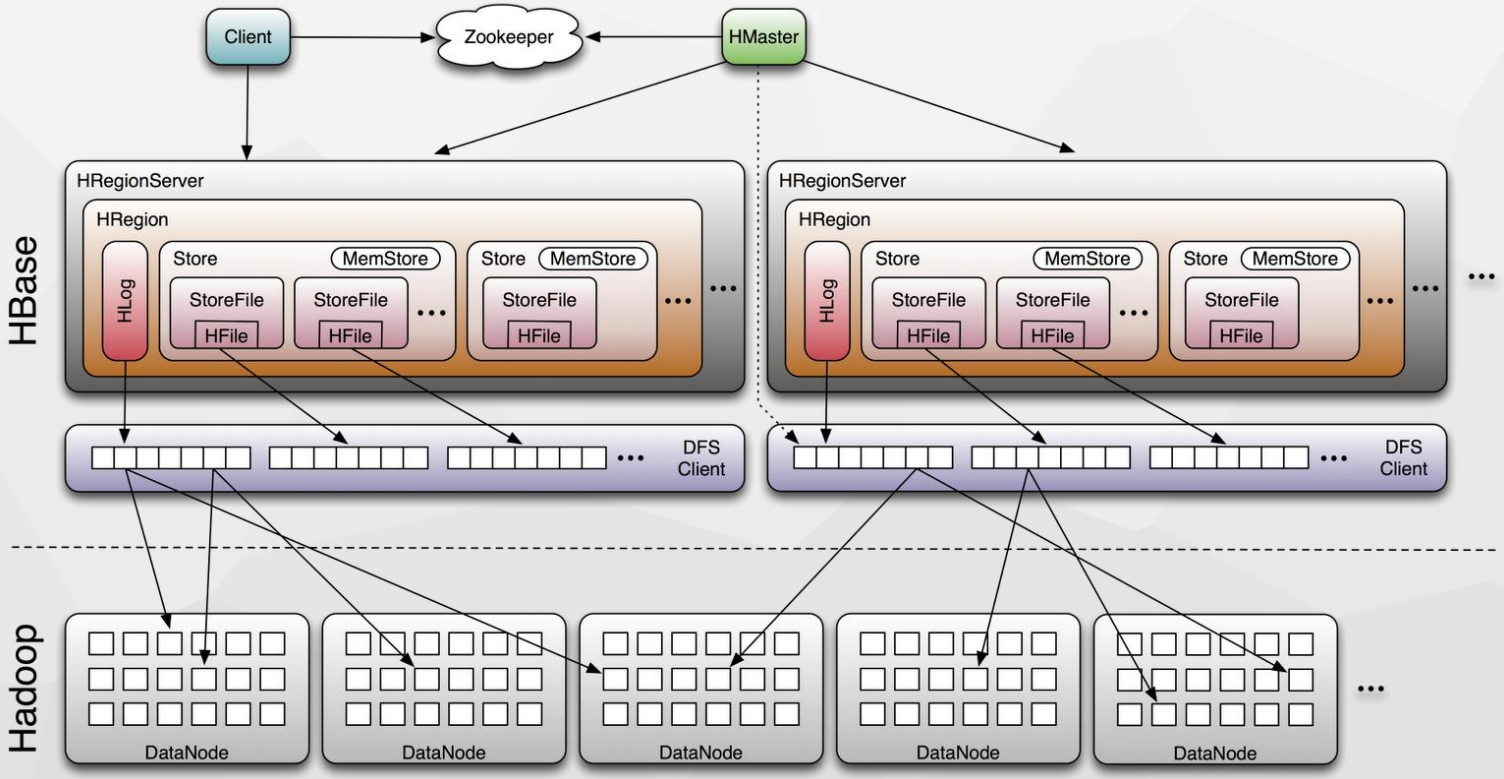
In HBase 0.98.5 and newer, you must set `JAVA_HOME` on each node of your cluster. *hbase-env.sh* provides a handy mechanism to do this.

https://hbase.apache.org/book.html

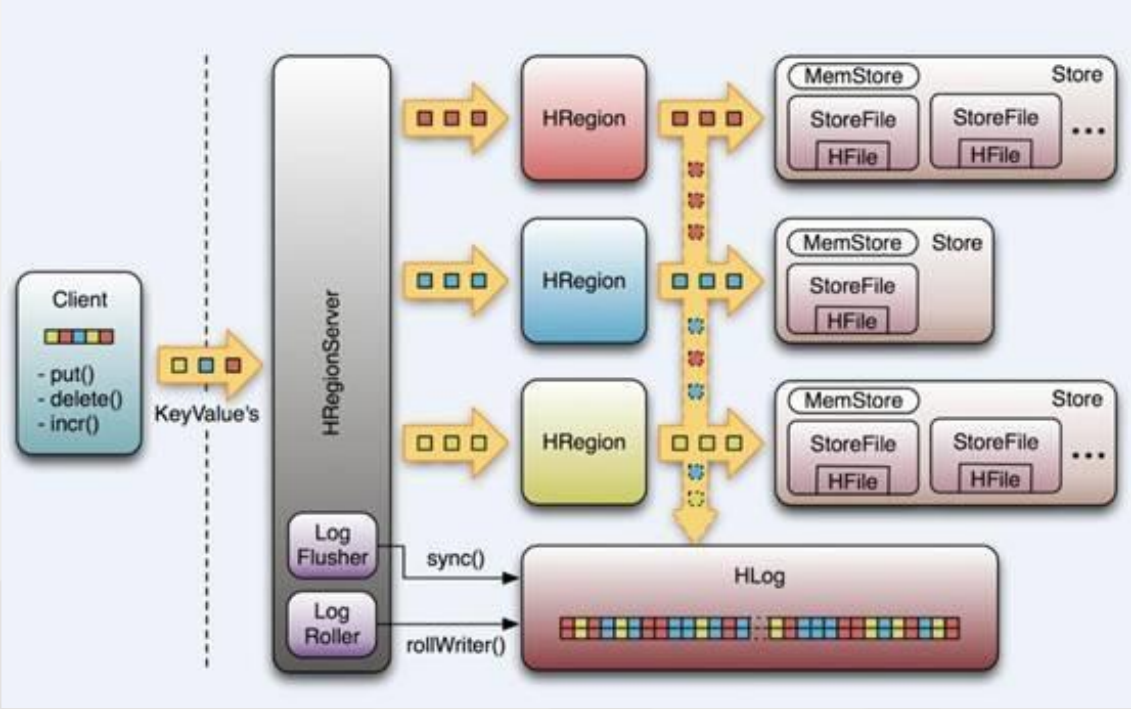
architecture


Zookeeper Service
/
/GroupMembers
/client1
/client2
/...
/client3
Register
Register
Register
Register
client1
client2
client3
...

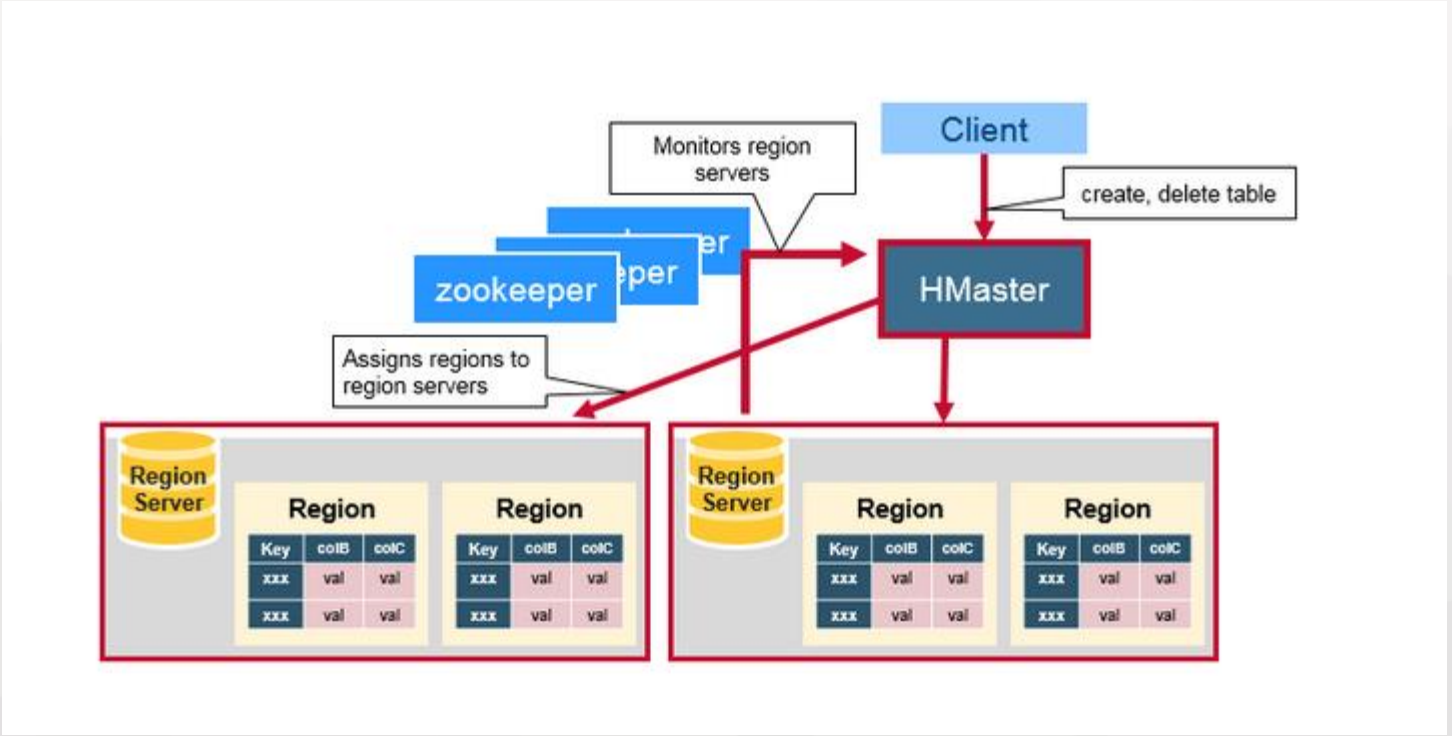
architecture



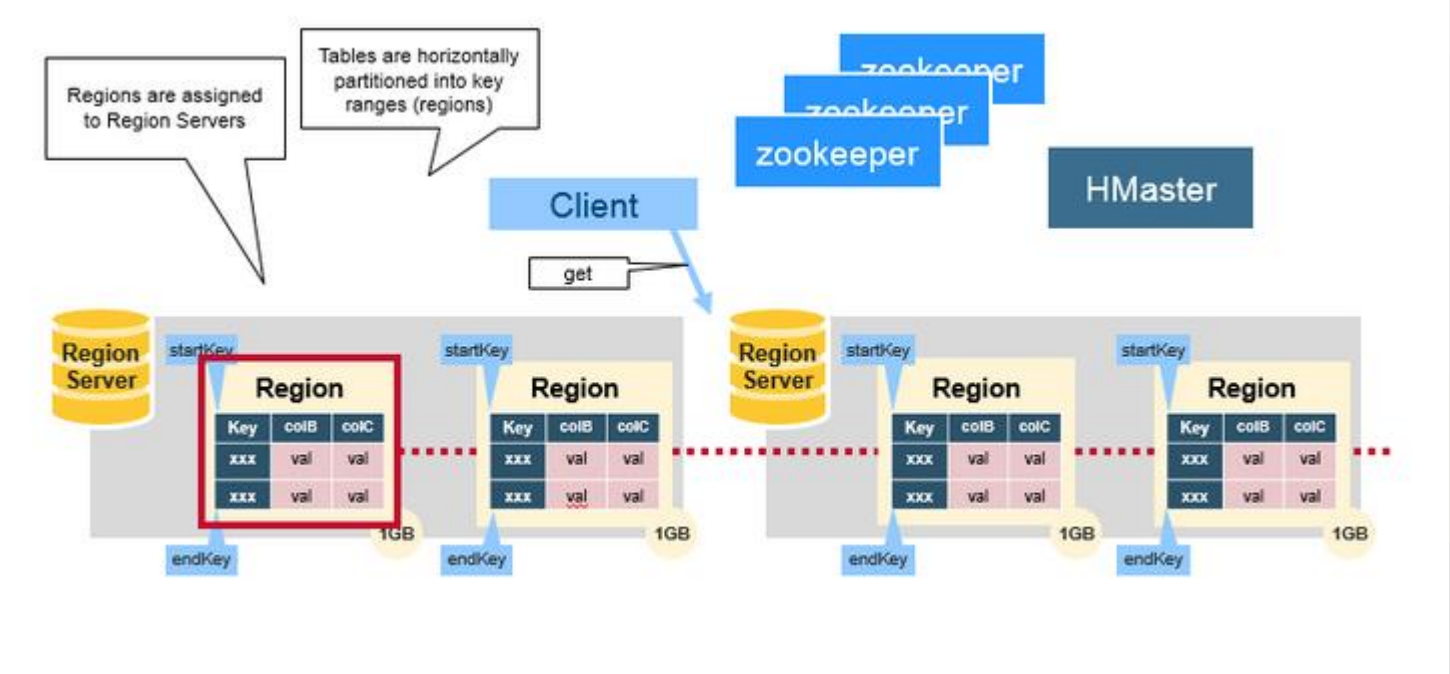
architecture



architecture



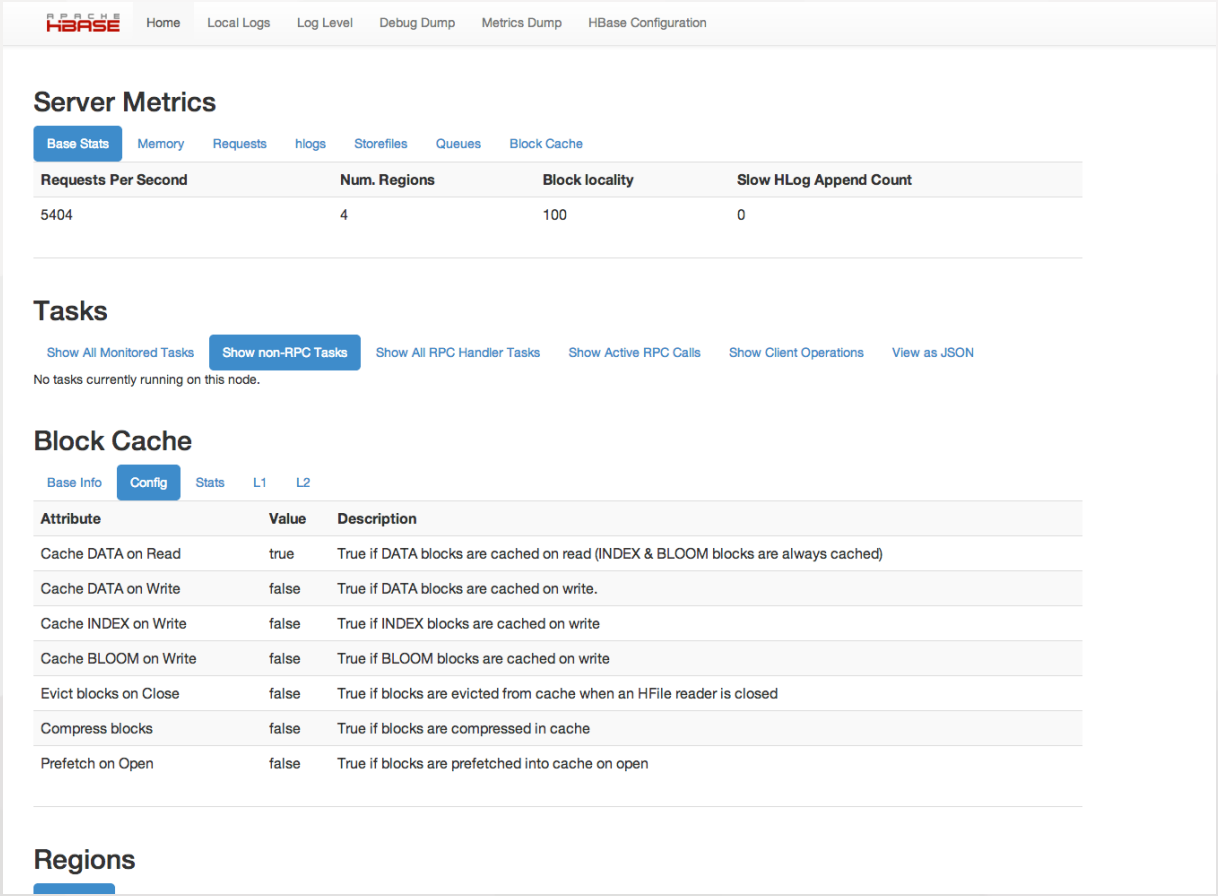
architecture



HBase Environment


Master
Slave
Master
Slave
Master
Slave
HBase-Base
Spark-Base
Hadoop-Base
DNS
OS

Web UI



HBase Home | Local Logs | Log Level | Debug Dump | Metrics Dump | HBase Configuration

Server Metrics

Base Stats | Memory | Requests | hlogs | Storefiles | Queues | Block Cache

Requests Per Second	Num. Regions	Block locality	Slow HLog Append Count
5404	4	100	0

Tasks

Show All Monitored Tasks | Show non-RPC Tasks | Show All RPC Handler Tasks | Show Active RPC Calls | Show Client Operations | View as JSON

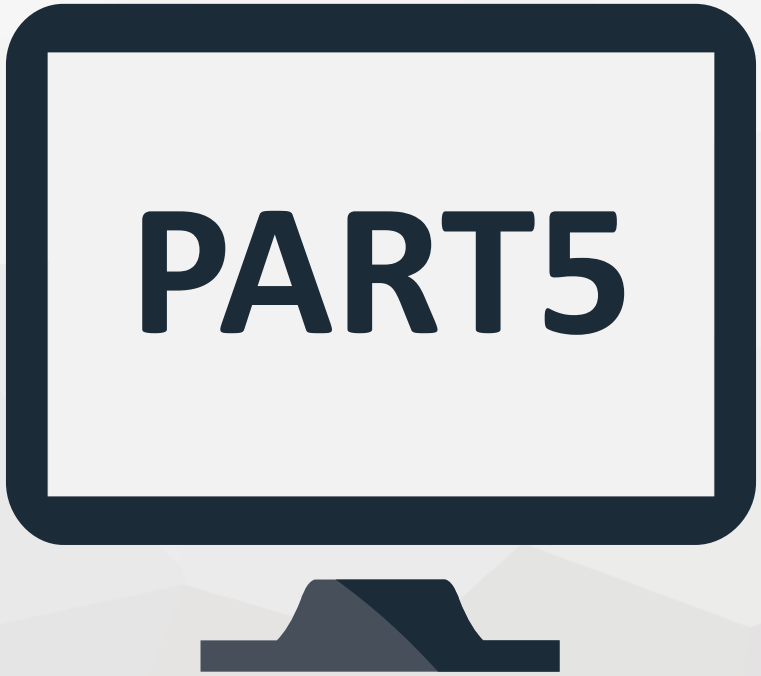
No tasks currently running on this node.

Block Cache

Base Info | Config | Stats | L1 | L2

Attribute	Value	Description
Cache DATA on Read	true	True if DATA blocks are cached on read (INDEX & BLOOM blocks are always cached)
Cache DATA on Write	false	True if DATA blocks are cached on write.
Cache INDEX on Write	false	True if INDEX blocks are cached on write
Cache BLOOM on Write	false	True if BLOOM blocks are cached on write
Evict blocks on Close	false	True if blocks are evicted from cache when an HFile reader is closed
Compress blocks	false	True if blocks are compressed in cache
Prefetch on Open	false	True if blocks are prefetched into cache on open

Regions



Quick Start

Quick Start


```
hbase(main):001:0> help
HBase Shell, version 0.91.0-SNAPSHOT, r1130916, Sat Jul 23 12:44:34 CEST 2011
Type 'help "COMMAND"', (e.g. 'help "get"' -- the quotes are necessary) for
help on a specific command. Commands are grouped. Type 'help "COMMAND_GROUP"',
(e.g. 'help "general"') for help on a command group.

COMMAND GROUPS:
  Group name: general
  Commands: status, version

  Group name: ddl
  Commands: alter, create, describe, disable, drop, enable, exists,
            is_disabled, is_enabled, list
```

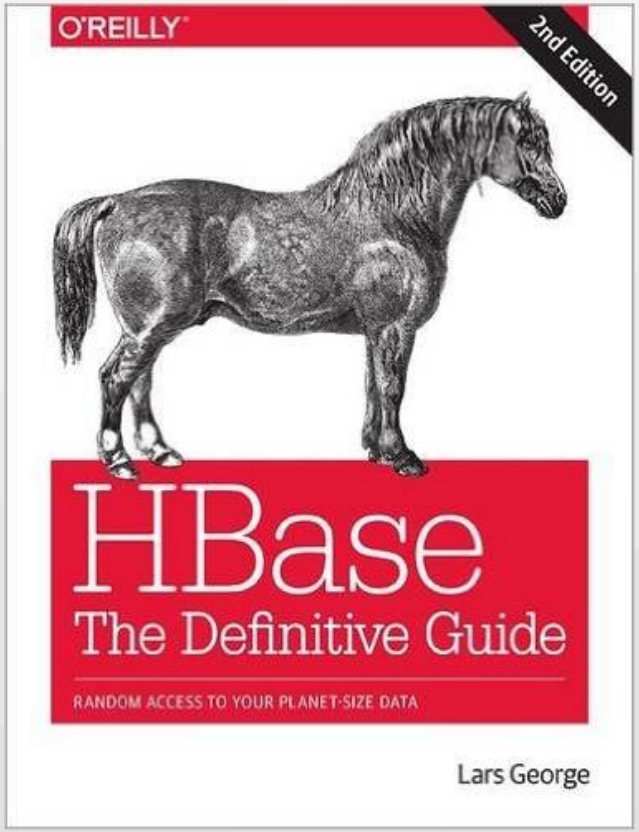
Quick Start

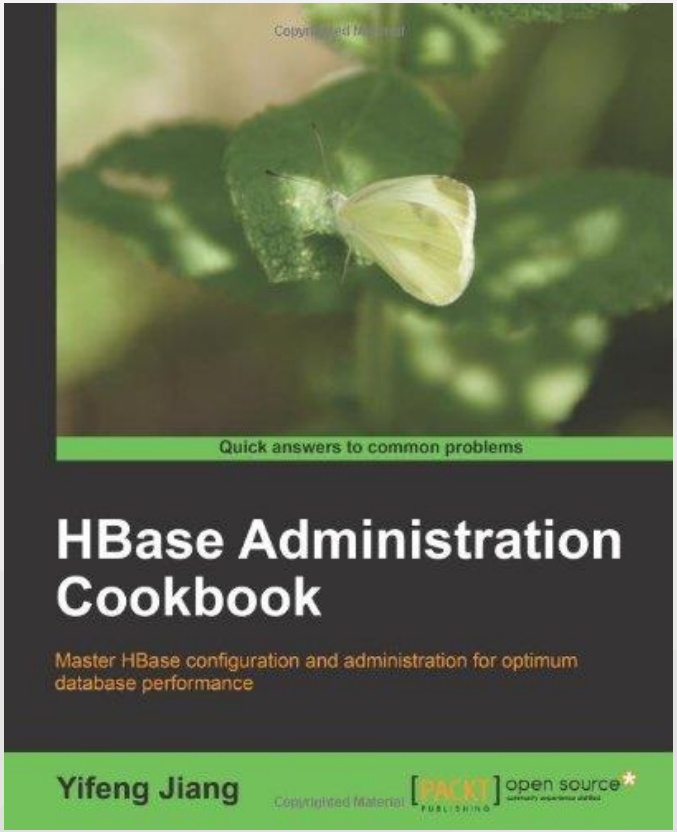

```
hbase(main):0xx:0>status
hbase(main):0xx:0>version
hbase(main):0xx:0>create 'member','member_id','address','info'
hbase(main):0xx:0>list
hbase(main):0xx:0>describe 'member‘
```

https://hbase.apache.org/book.html

Reference Books

Books


O'REILLY
2nd Edition
HBase
The Definitive Guide
RANDOM ACCESS TO YOUR PLANET-SIZE DATA
Lars George


Quick answers to common problems
HBase Administration Cookbook
Master HBase configuration and administration for optimum database performance
Yifeng Jiang
PACKT PUBLISHING
open source


The End