Introduction to Replication and Replica Sets

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mongoDB

Agenda

- Replica Sets Lifecycle
- Developing with Replica Sets
- Operational Considerations

Why Replication?

- How many have faced node failures?
- How many have been woken up from sleep to do a fail-over(s)?
- How many have experienced issues due to network latency?
- Different uses for data
  - Normal processing
  - Simple analytics

Replica Set Lifestyle

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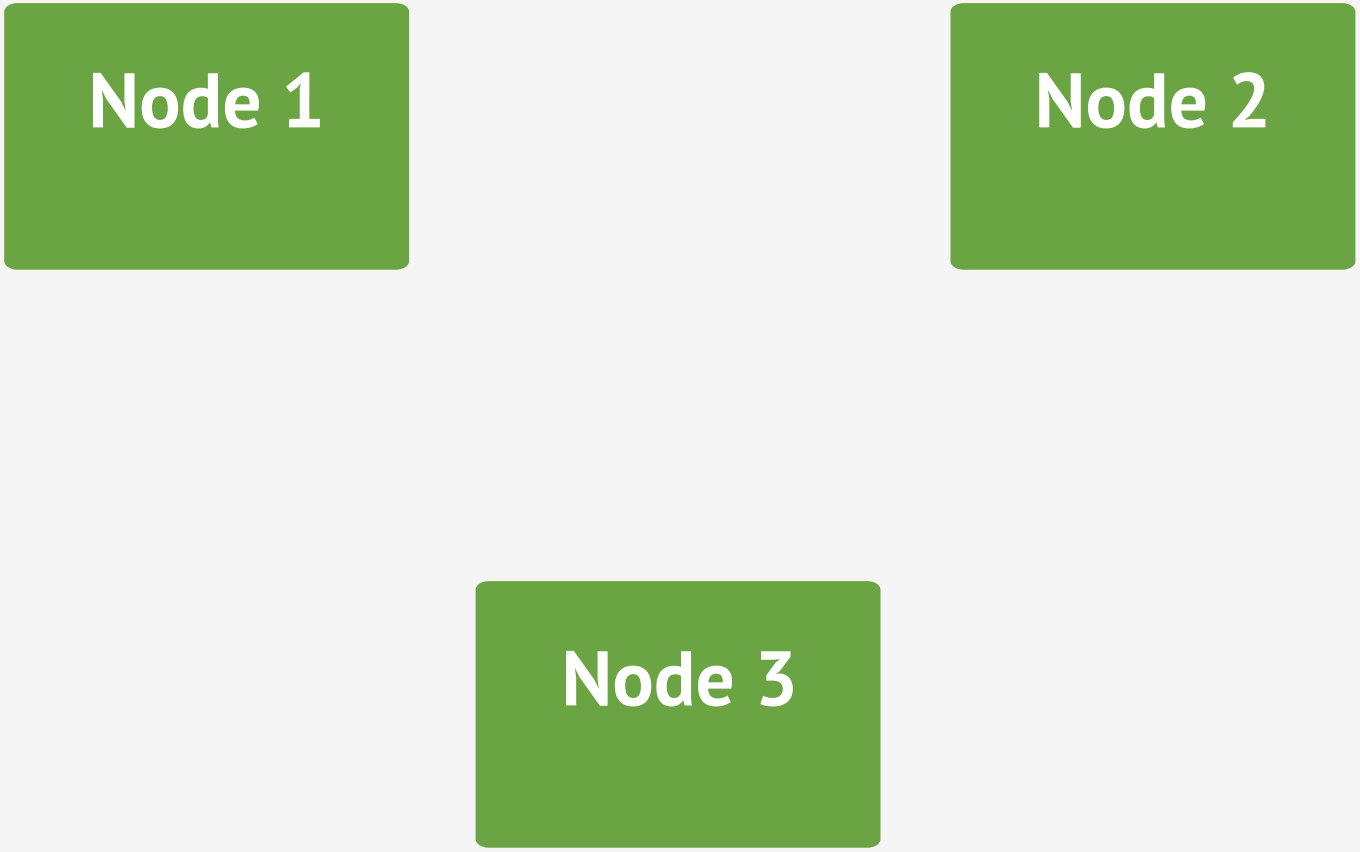
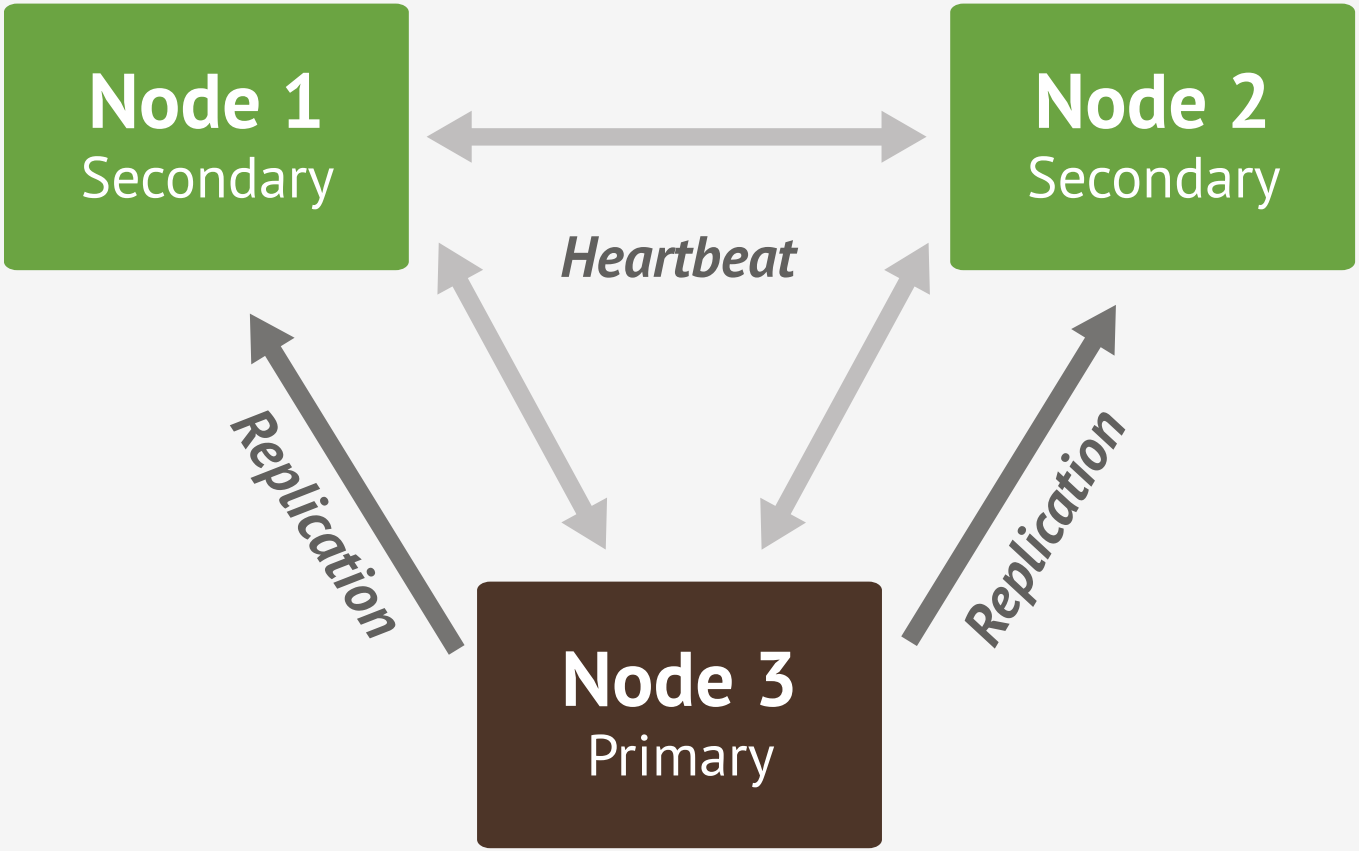
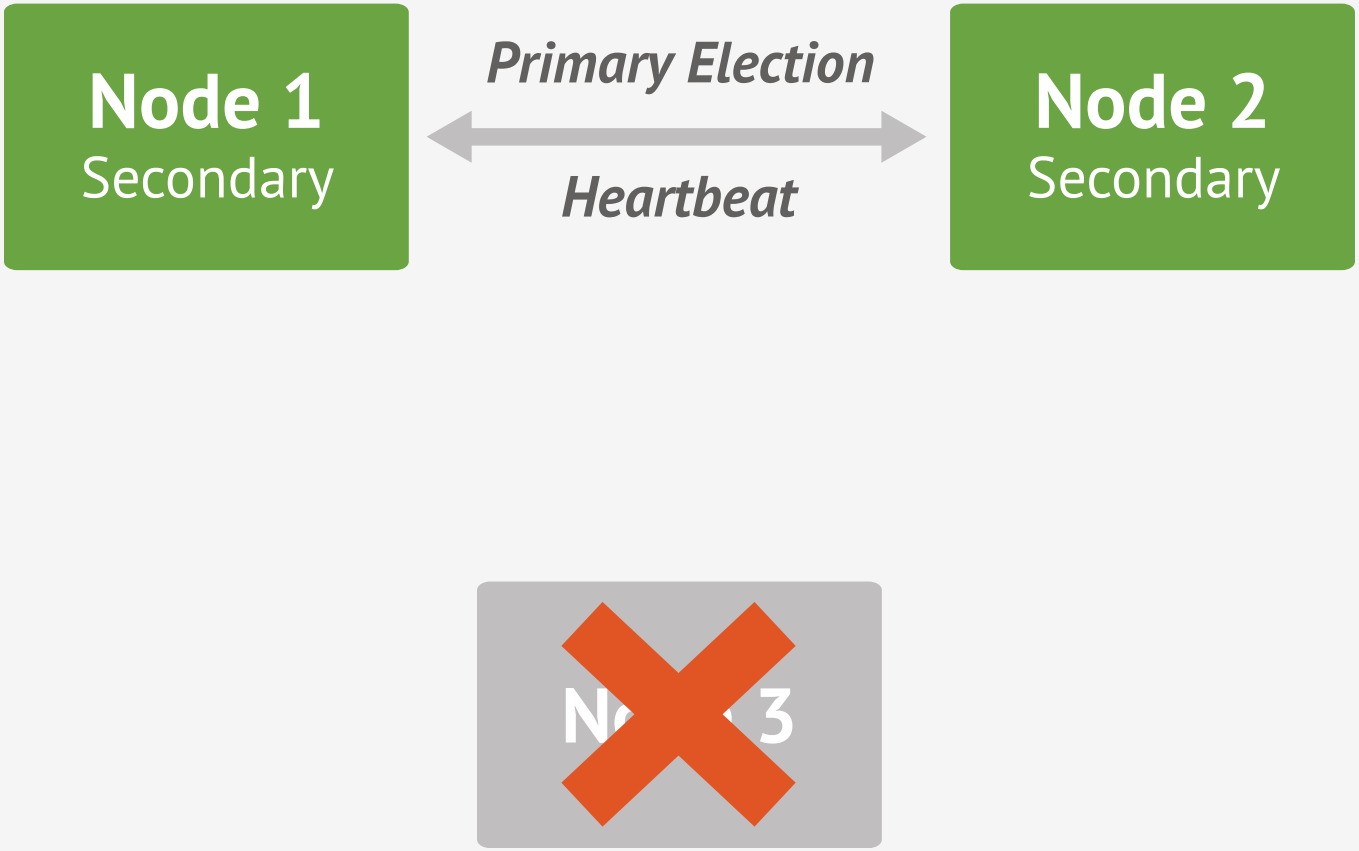


Replica Set – Creation

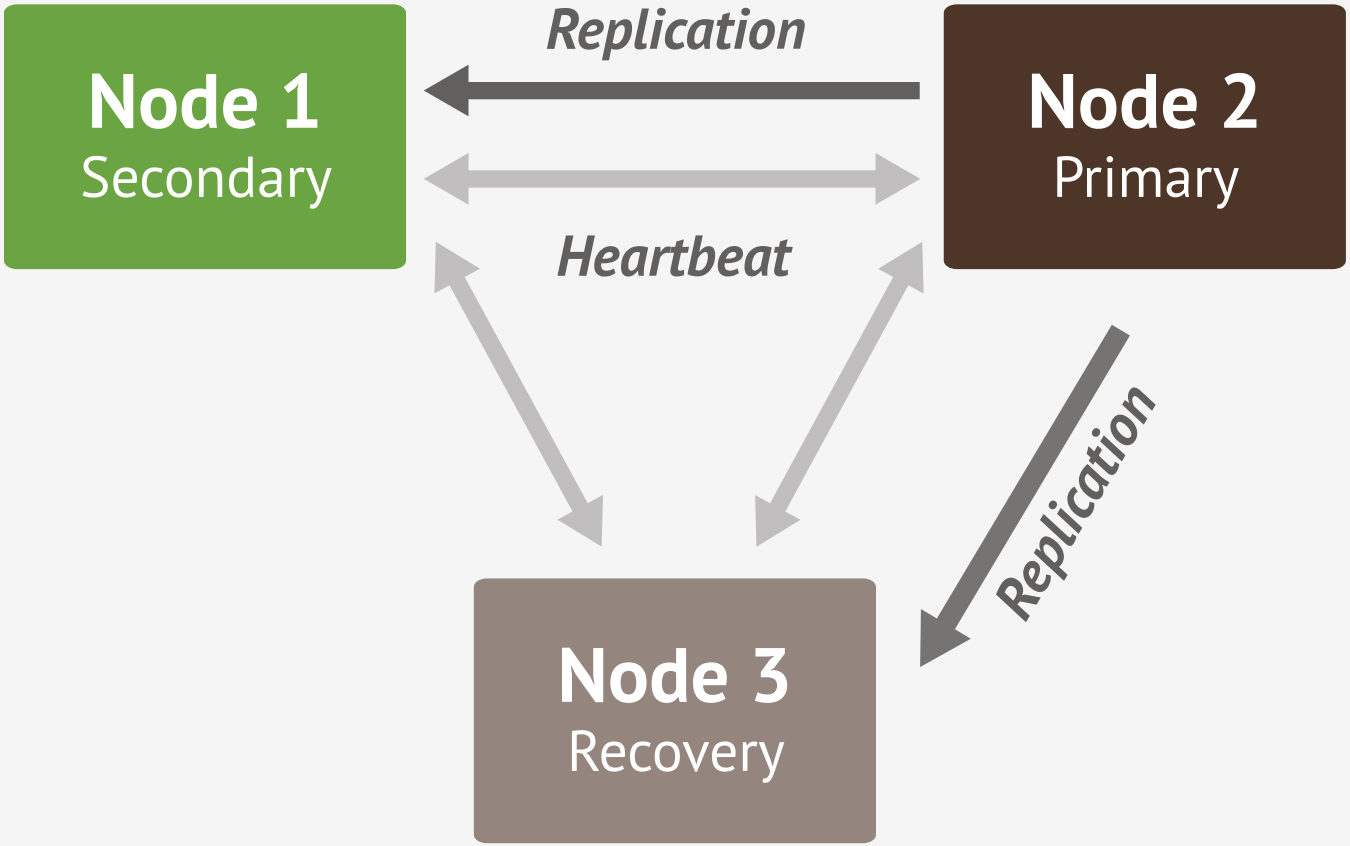


Replica Set – Initialize

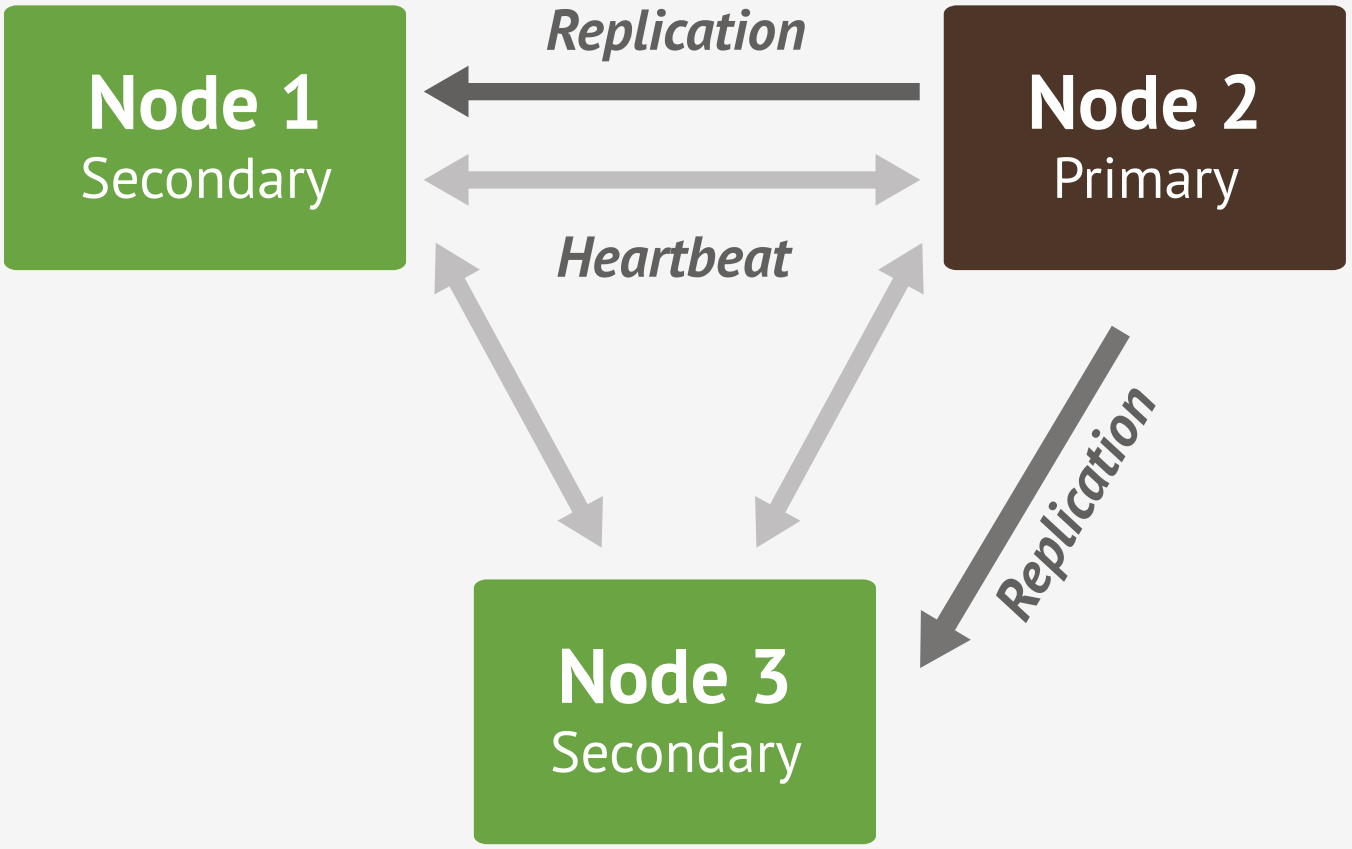


Replica Set – Failure

Replica Set – Failover



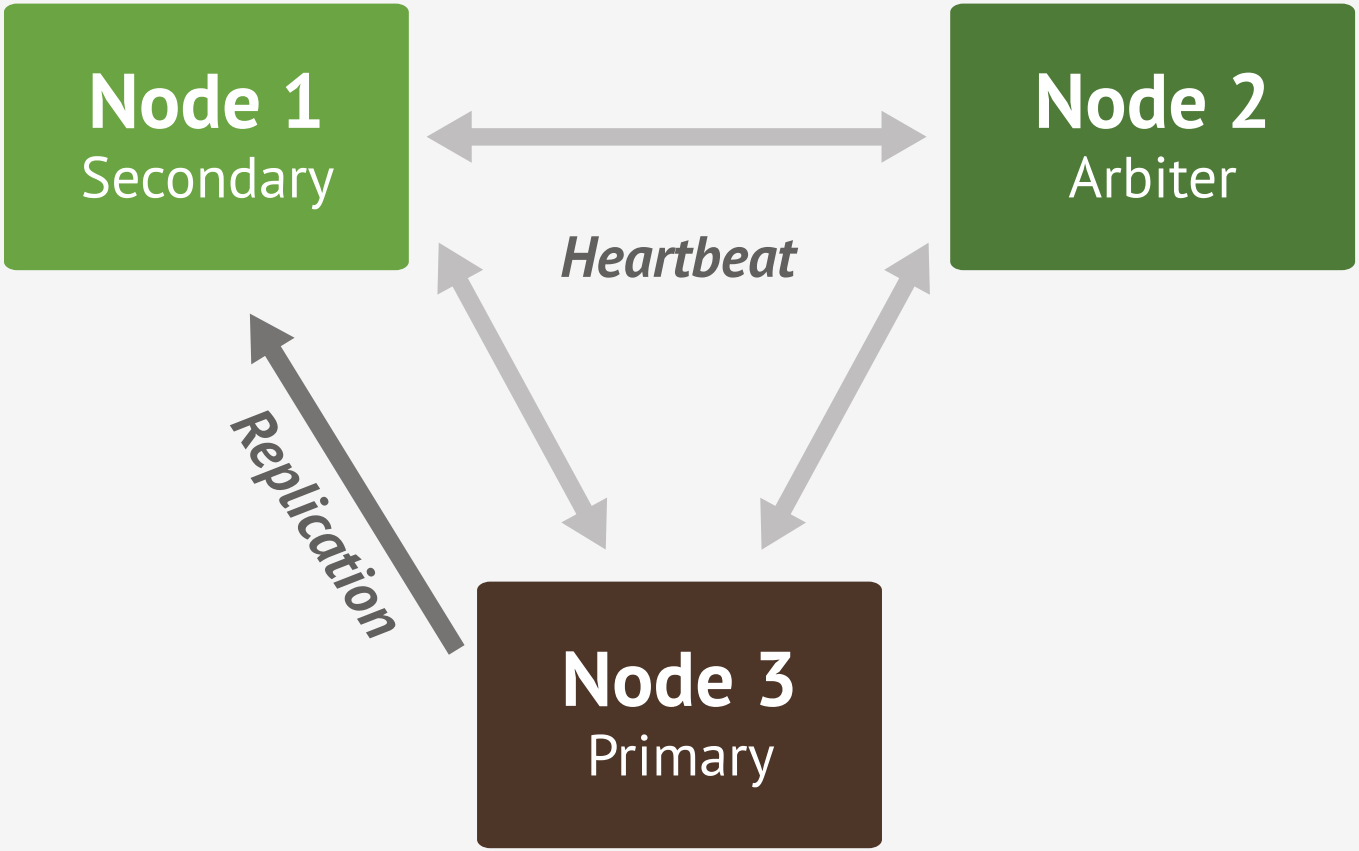
Replica Set – Recovery



Replica Set – Recovered

Replica Set Roles & Configuration

mongoDB



Replica Set Roles

Configuration Options

```
> conf = {
    _id : "mySet",
    members : [
       {_id : 0, host : "A”, priority : 3},
       {_id : 1, host : "B", priority : 2},
       {_id : 2, host : "C”},
       {_id : 3, host : "D", hidden : true},
       {_id : 4, host : "E", hidden : true, slaveDelay : 3600}
     ]
}

> rs.initiate(conf)
```

Configuration Options

```
> conf = {
    _id : "mySet”,
    members : [
      {_id : 0, host : "A”, priority : 3},
      {_id : 1, host : "B", priority : 2},
      {_id : 2, host : "C”},
      {_id : 3, host : "D", hidden : true},
      {_id : 4, host : "E", hidden : true, slaveDelay : 3600}
     ]
}

> rs.initiate(conf)
```

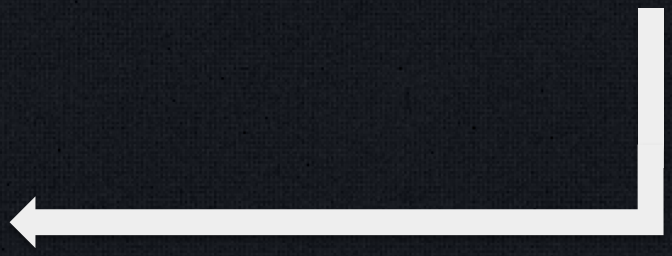
Primary DC ⬇

Configuration Options

```
> conf = {
    _id : "mySet”,
    members : [
      {_id : 0, host : "A”, priority : 3},
      {_id : 1, host : "B", priority : 2},
      {_id : 2, host : "C”},
      {_id : 3, host : "D", hidden : true},
      {_id : 4, host : "E", hidden : true, slaveDelay : 3600}
     ]
}

> rs.initiate(conf)
```

Secondary DC
Default Priority = 1



Configuration Options

```
> conf = {
    _id : "mySet”,
    members : [
       {_id : 0, host : "A”, priority : 3},
       {_id : 1, host : "B", priority : 2},
       {_id : 2, host : "C”},
       {_id : 3, host : "D", hidden : true},
       {_id : 4, host : "E", hidden : true, slaveDelay : 3600}
     ]
}

> rs.initiate(conf)
```

Analytics node

Configuration Options

```
> conf = {
    _id : "mySet”,
    members : [
      {_id : 0, host : "A”, priority : 3},
      {_id : 1, host : "B", priority : 2},
      {_id : 2, host : "C”},
      {_id : 3, host : "D", hidden : true},
      {_id : 4, host : "E", hidden : true, slaveDelay : 3600}
    ]
}

> rs.initiate(conf)
```

Backup node ⬆

Developing with Replica Sets

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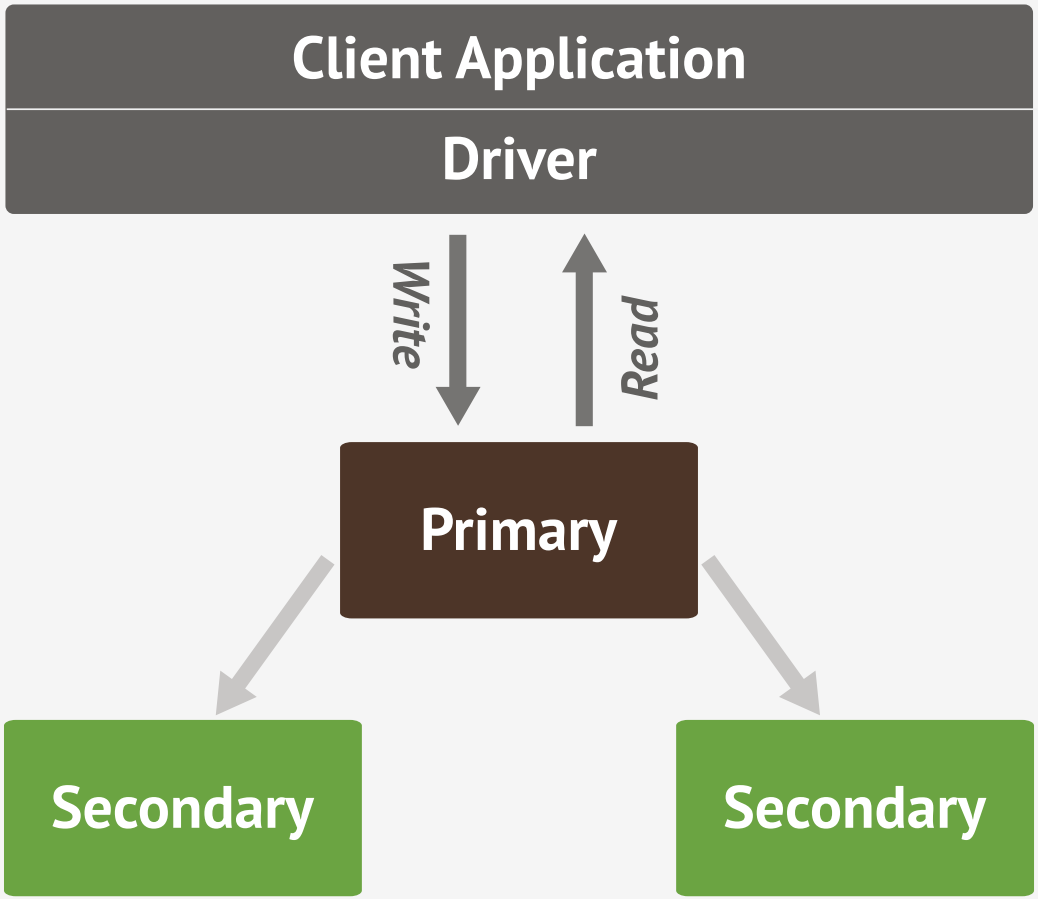
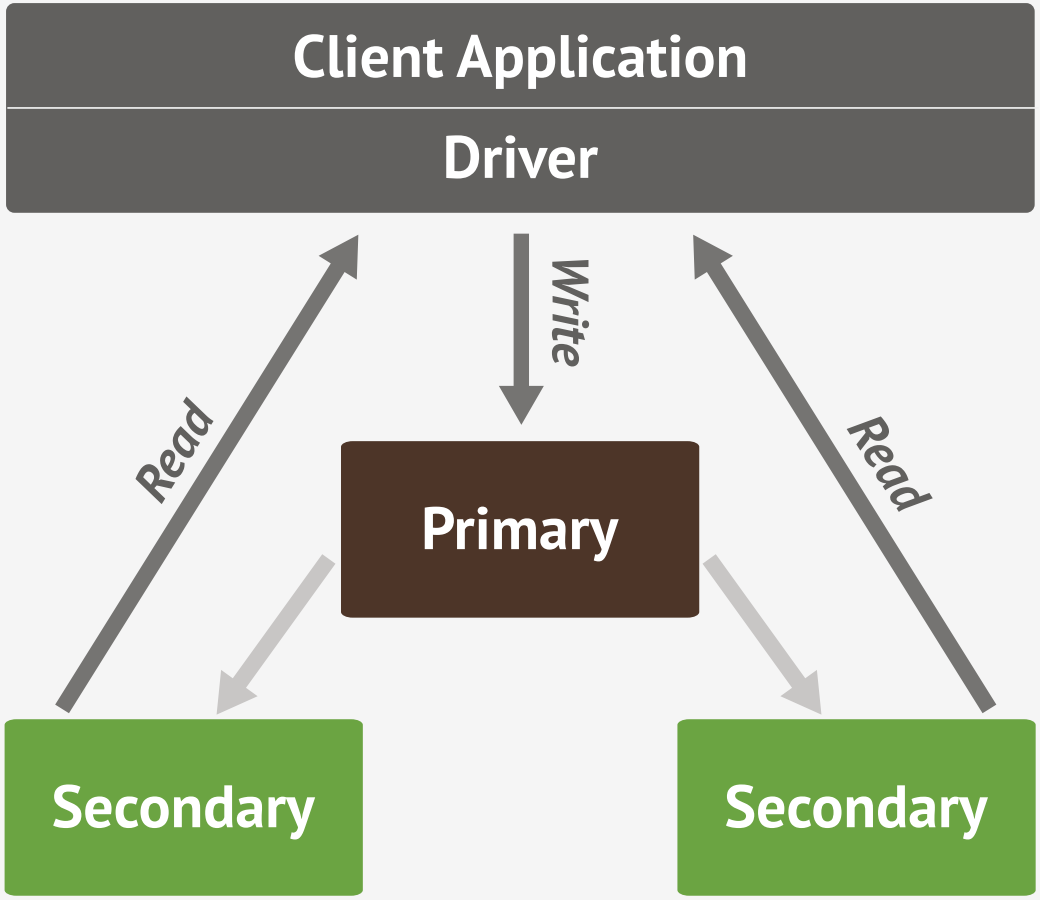


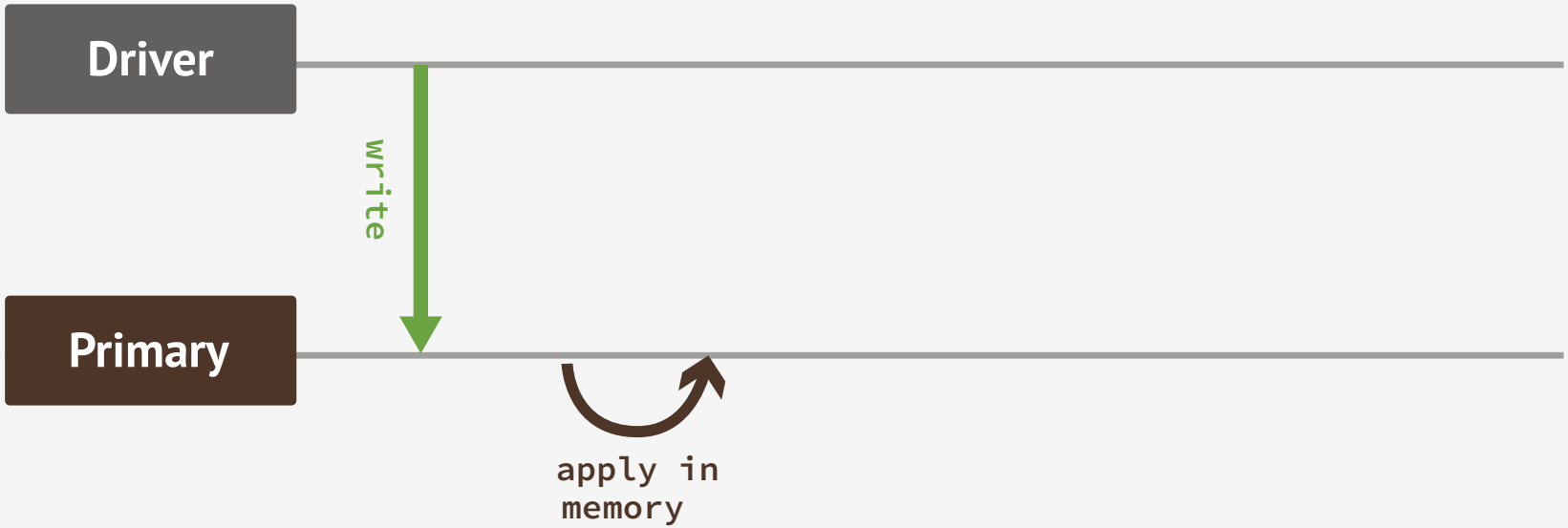
Strong Consistency



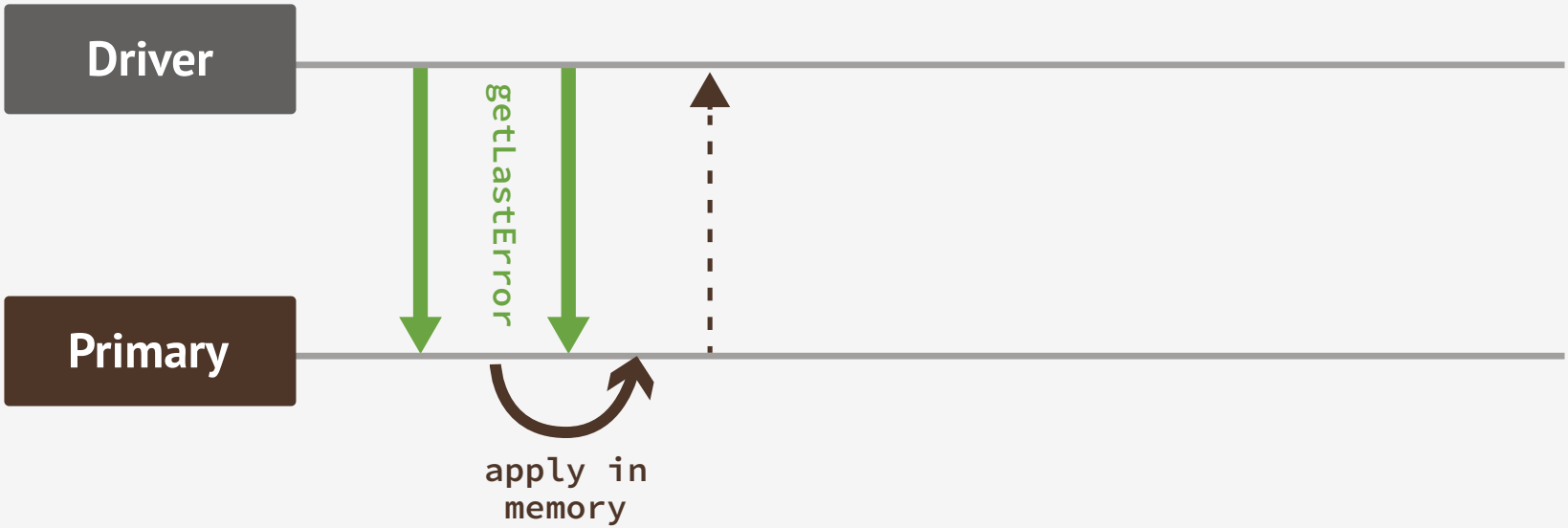
Delayed Consistency

Write Concern

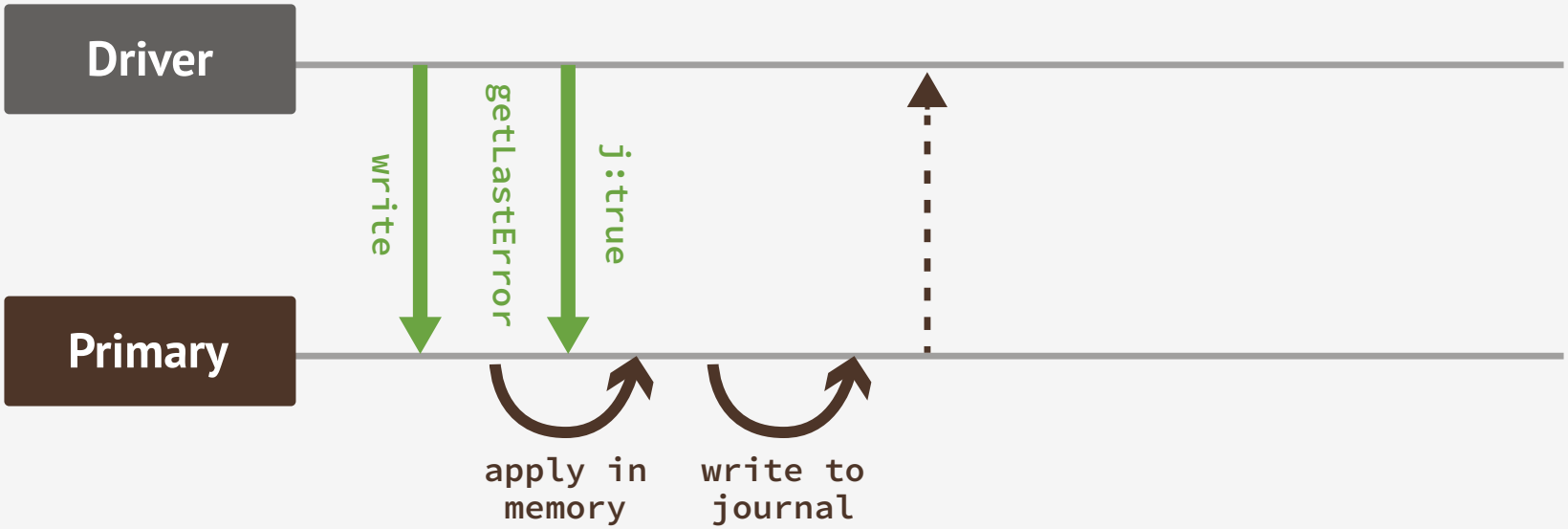
- Network acknowledgement
- Wait for error
- Wait for journal sync
- Wait for replication



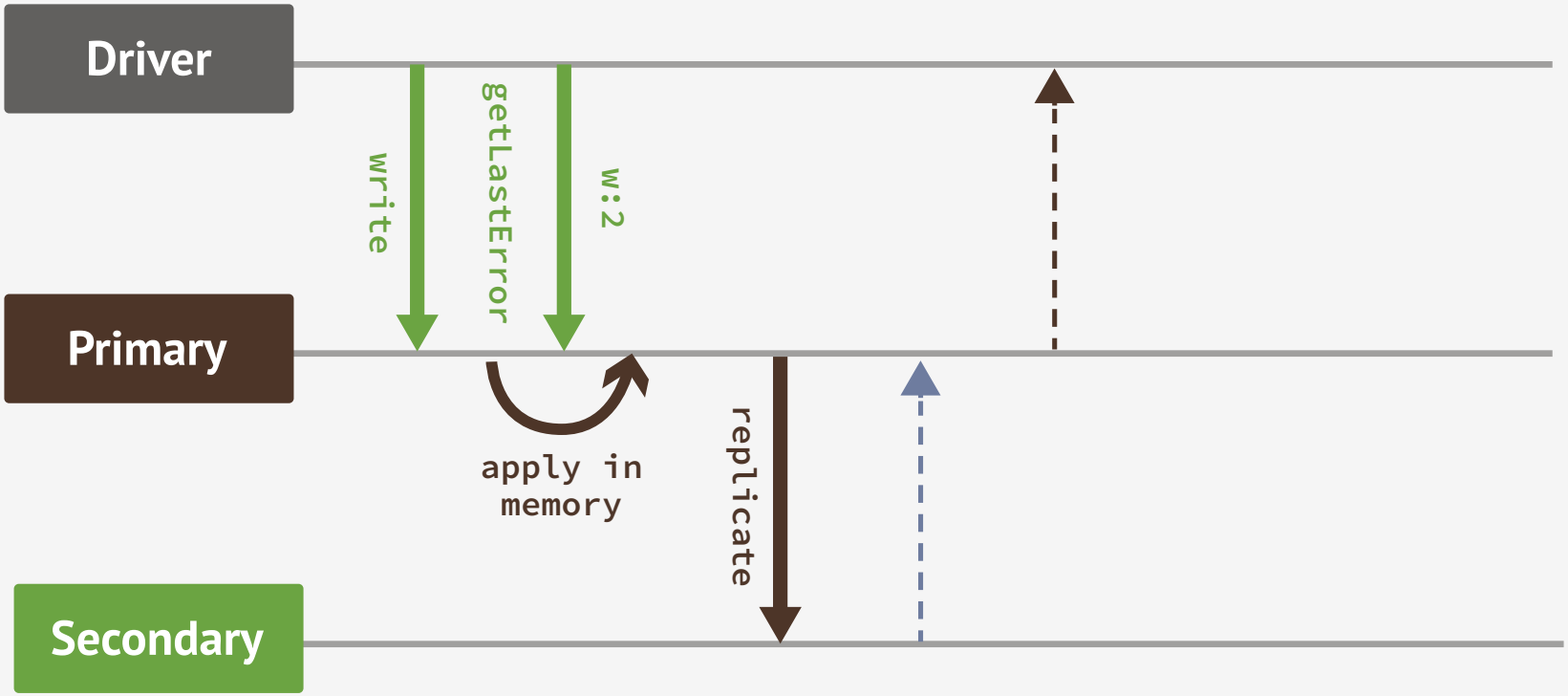
Unacknowledged



MongoDB Acknowledged (wait for error)



Wait for Journal Sync



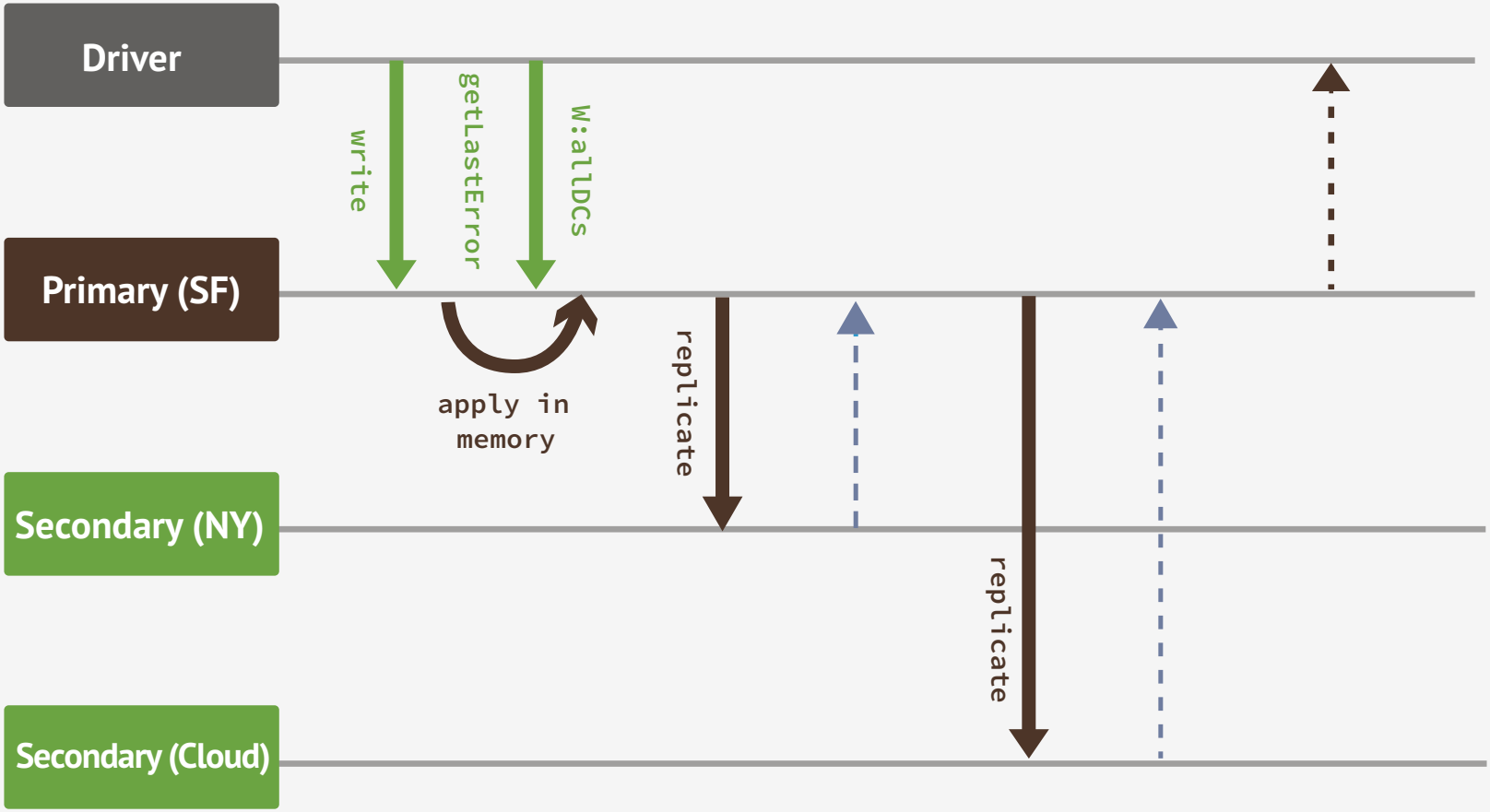
Wait for Replication

Tagging

- Control where data is written to, and read from
- Each member can have one or more tags
  - tags: {dc: "ny"}
  - tags: {dc: "ny",
    subnet: "192.168",
    rack: "row3rk7"}
- Replica set defines rules for write concerns
- Rules can change without changing app code

Tagging Example

```
{
    _id : "mySet",
    members : [
        {_id : 0, host : "A", tags : {"dc": "ny"}},
        {_id : 1, host : "B", tags : {"dc": "ny"}},
        {_id : 2, host : "C", tags : {"dc": "sf"}},
        {_id : 3, host : "D", tags : {"dc": "sf"}},
        {_id : 4, host : "E", tags : {"dc": "cloud"}}],
    settings : {
        getLastErrorModes : {
            allDCs :  {"dc" : 3},
            someDCs : {"dc" : 2}} }
}
> db.blogs.insert({...})
> db.runCommand({getLastError : 1, w : "someDCs"})
```



Wait for Replication (Tagging)

Read Preference Modes

- 5 modes
  - primary (only) - Default
  - primaryPreferred
  - secondary
  - secondaryPreferred
  - Nearest

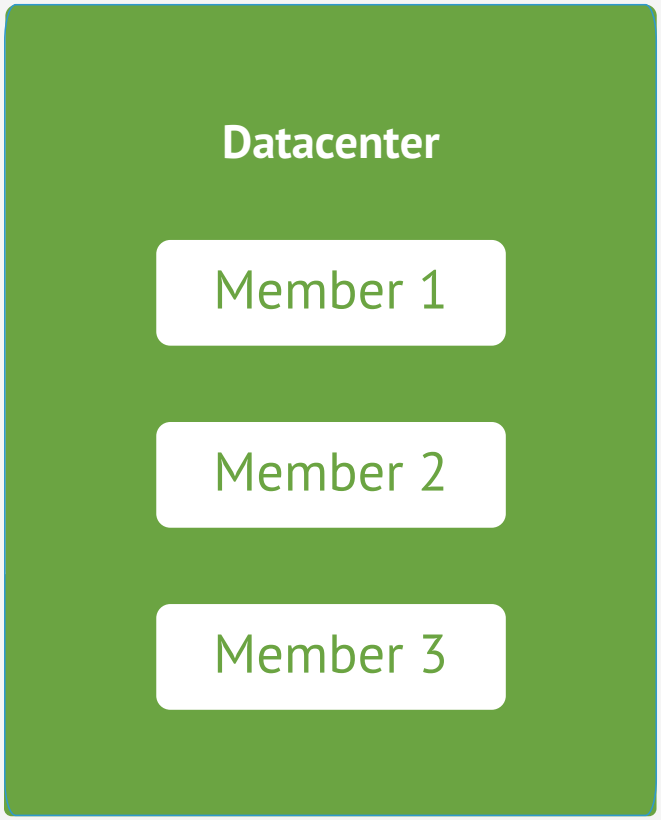
  When more than one node is possible, closest node is used for reads (all modes but primary)

Operational Considerations

Maintenance and Upgrade

- No downtime
- Rolling upgrade/maintenance
  - Start with Secondary
  - Primary last

Replica Set – 1 Data Center



Single datacenter

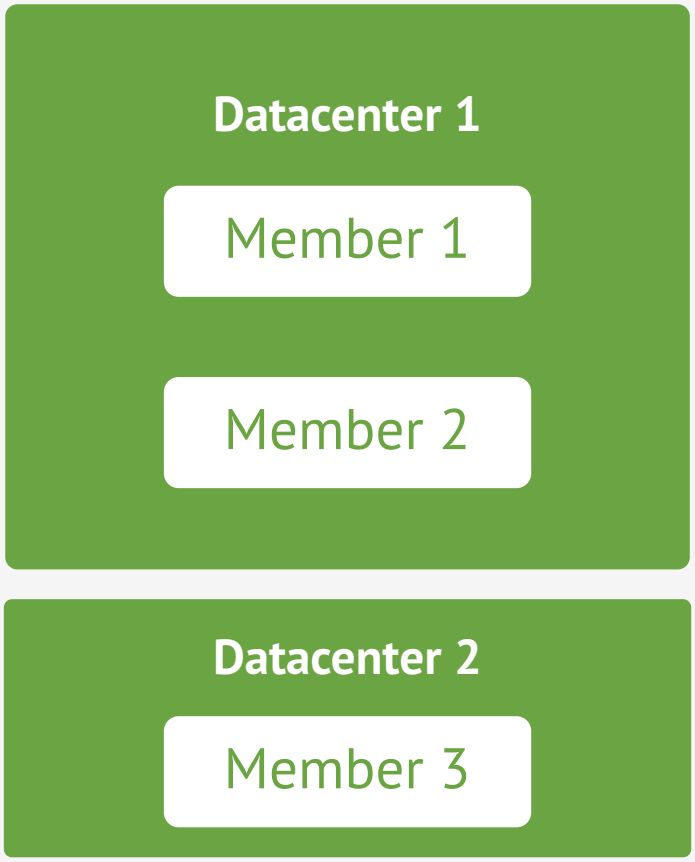
Single switch & power

Points of failure:

- Power
- Network
- Data center
- Two node failure

Automatic recovery of single node crash

Replica Set – 2 Data Centers

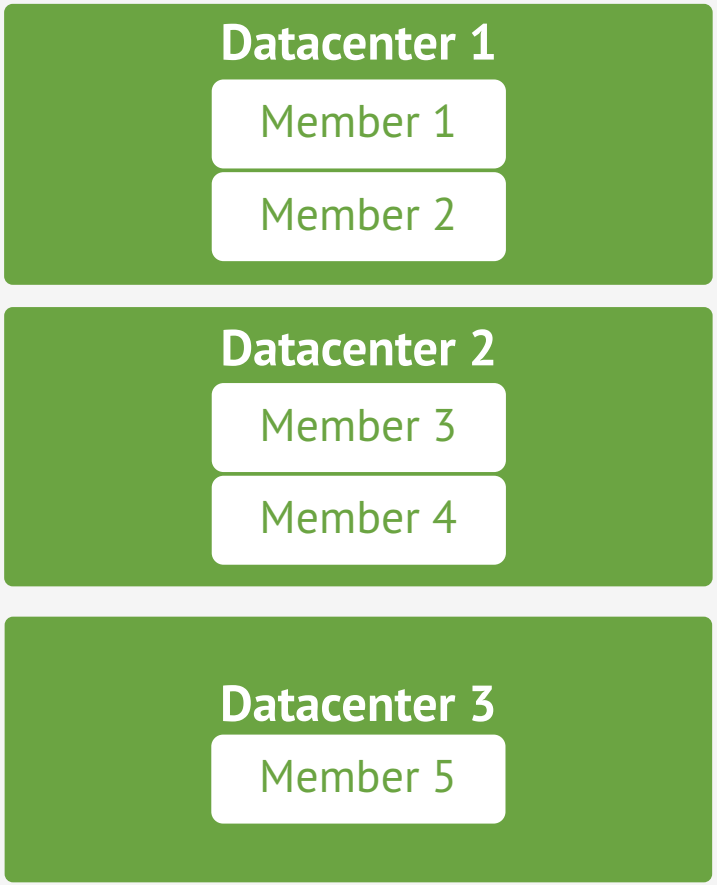


Multi data center

DR node for safety

Can't do multi data center durable write safely since only 1 node in distant DC

Replica Set – 3 Data Centers



Three data centers

Can survive full data center loss

Can do w= { dc : 2 } to guarantee write in 2 data centers (with tags)

Behind the Curtain

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Implementation details

- Heartbeat every 2 seconds
  - Times out in 10 seconds
- Local DB (not replicated)
  - system.replset
  - oplog.rs
    - Capped collection
    - Idempotent version of operation stored

Op(erations) Log is idempotent

```
> db.replsettest.insert({_id:1,value:1})

{ "ts" : Timestamp(1350539727000, 1), "h" :
NumberLong("6375186941486301201"), "op" : "i", "ns" :
"test.replsettest", "o" : { "_id" : 1, "value" : 1 } }


> db.replsettest.update({_id:1},{$inc:{value:10}})

{ "ts" : Timestamp(1350539786000, 1), "h" :
NumberLong("5484673652472424968"), "op" : "u", "ns" :
"test.replsettest", "o2" : { "_id" : 1 },
 "o" : { "$set" : { "value" : 11 } } }
```

Single operation can have many entries

```
> db.replsettest.update({},{$set:{name : ”foo”}, false, true})

{ "ts" : Timestamp(1350540395000, 1), "h" :
NumberLong("-4727576249368135876"), "op" : "u", "ns" :
"test.replsettest", "o2" : { "_id" : 2 }, "o" : { "$set" : { "name" :
"foo" } } }

{ "ts" : Timestamp(1350540395000, 2), "h" :
NumberLong("-72929496132592601 38"), "op" : "u", "ns" :
"test.replsettest", "o2" : { "_id" : 3 }, "o" : { "$set" : { "name" :
"foo" } } }

{ "ts" : Timestamp(1350540395000, 3), "h" :
NumberLong("-1888768148831990635"), "op" : "u", "ns" :
"test.replsettest", "o2" : { "_id" : 1 }, "o" : { "$set" : { "name" :
"foo" } } }
```

Recent improvements

- Read preference support with sharding
  - Drivers too
- Improved replication over WAN/high-latency networks
- rs.syncFrom command
- buildIndexes setting
- replIndexPrefetch setting

Just Use It

Use replica sets

Easy to setup

- Try on a single machine

Check doc page for RS tutorials

- http://docs.mongodb.org/manual/replication/#tutorials

Questions?

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Thank You
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