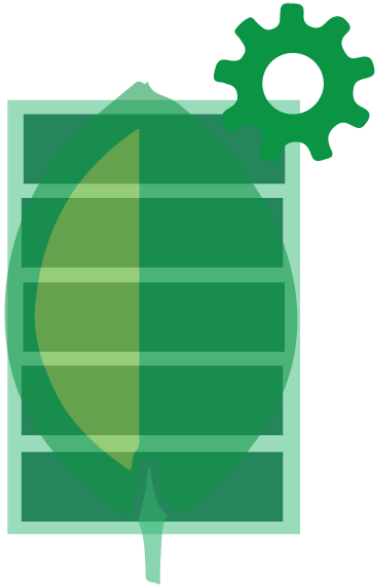

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MODULE-5
REPLICATION AND SHARDING

Course Topics

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- Module 1
  - Design Goals, Architecture and Installation
- Module 2
  - CRUD Operations
- Module 3
  - Schema Design and Data Modelling
- Module 4
  - Administration
- Module 5
  - **Scalability and Availability**
- Module 6
  - Indexing and Aggregation Framework
- Module 7
  - Application Engineering and MongoDB Tools
- Module 8
  - Project, Additional Concepts and Case Studies

Objectives

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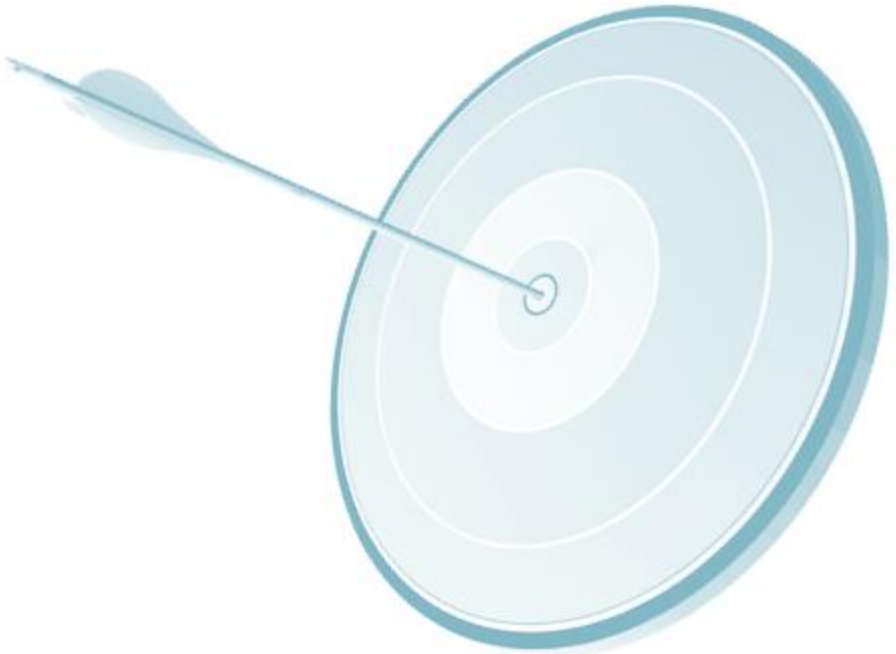
At the end of this module, you will be able to

→ Understand the concepts of replica set

→ Understand the concept of sharing in MongoDB®

→ Create a production like sharded cluster



Annie's Question

What is MMS and mention the use of it?

Annie's Answer

MongoDB® Management Services, it is used to administer MongoDB ® database.

Annie's Question

What is mongostat?

Annie's Answer

Utility that comes with MongoDB distribution. This is used to monitor MongoDB performance.

Annie's Question

How can we access the HTTP console in MongoDB®?

Annie's Answer

Through http://localhost:28017 – by default. It is basically accessible through the port 1000 more than the port on which mongod is running.

Annie's Question

When page fault occurs in MongoDB®?

Annie's Answer

A page fault occurs when MongoDB® requires data not located in physical memory, and must read from virtual memory.

Replication

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→ The process of creating and managing duplicate versions of a database.

→ Replication provides redundancy and increases data availability.

→ It synchronizes a set of replicas so that changes made to one replica are reflected in all the others.

→ Enables many users to work with their own local copy of a database.

→ With additional copies of the data, you can dedicate one to disaster recovery, reporting, or backup.

Why is Replication?

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- → To keep your data safe.
- → High (24/7) availability of data.
- → Disaster recovery.
- → No downtime for maintenance (like backups, index rebuilds, compaction).
- → Read scaling (extra copies to read from).
- → Replica set is transparent to the application.

Replication in MongoDB®

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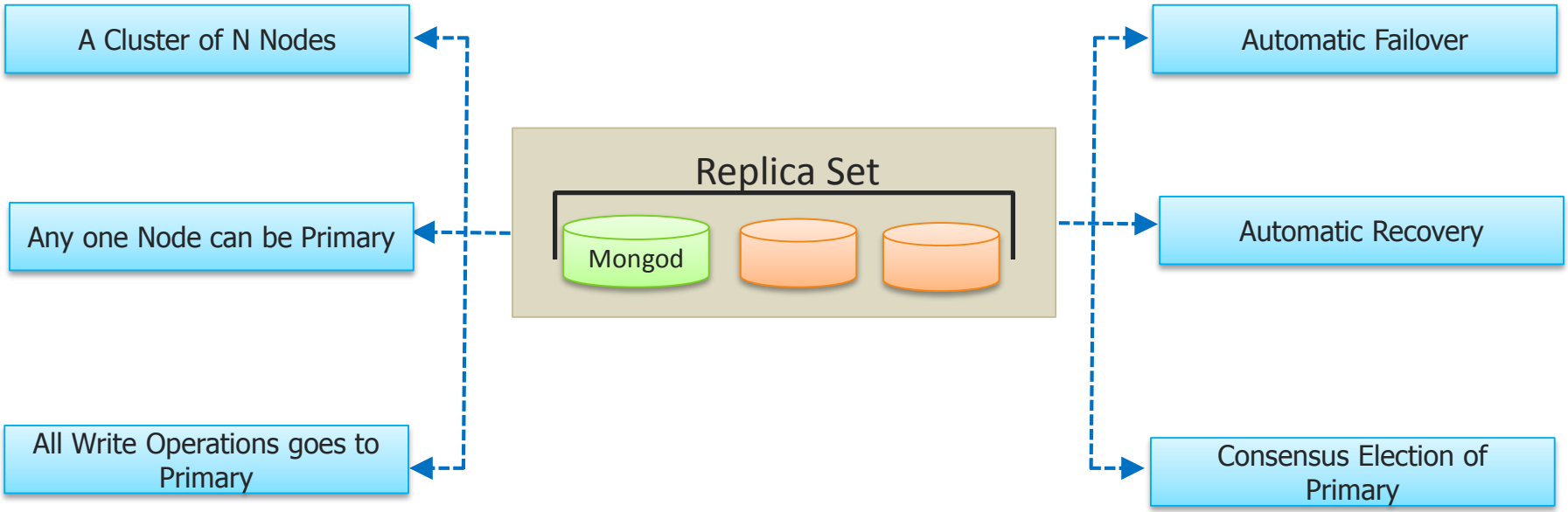
- → A replica set is a group of mongod instances that host the same data set.
- → One mongod, the primary, receives all write operations.
- → All other instances, secondary's.
- → The primary accepts all write operations from clients.
- → Replica set can have only one primary.
- → Replica sets provide strict consistency.

Replication Set Features



Replication in MongoDB®

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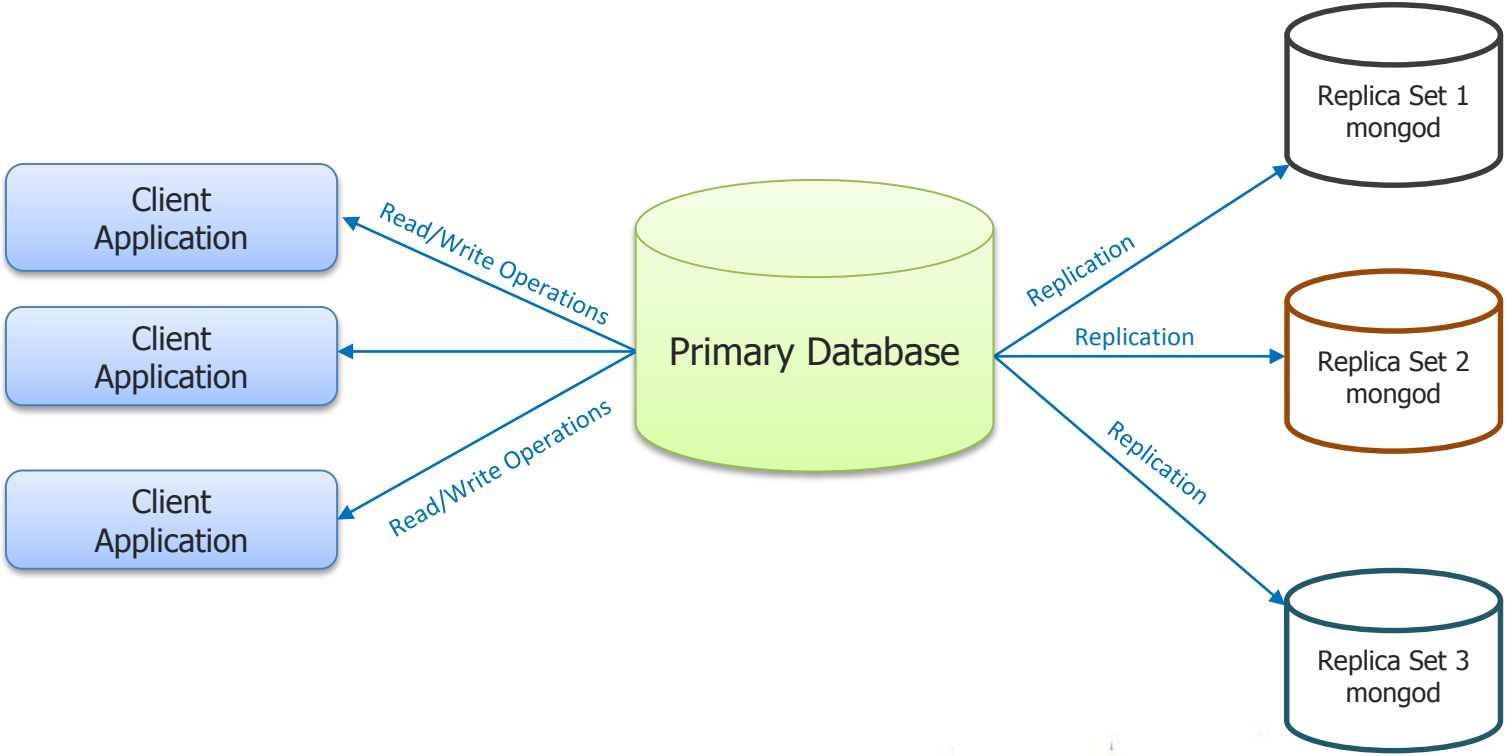
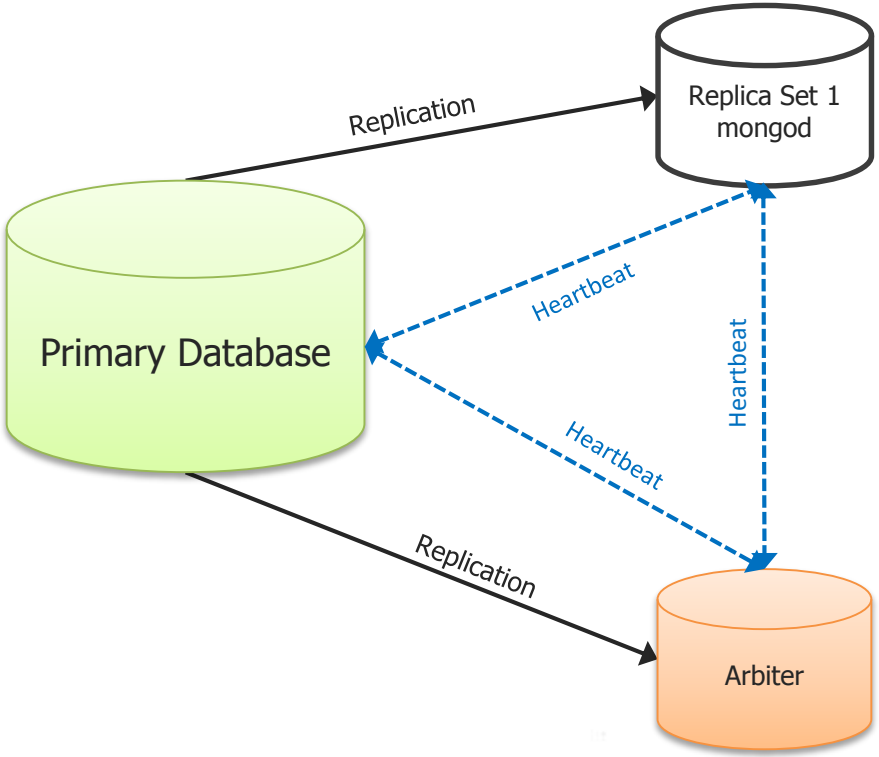
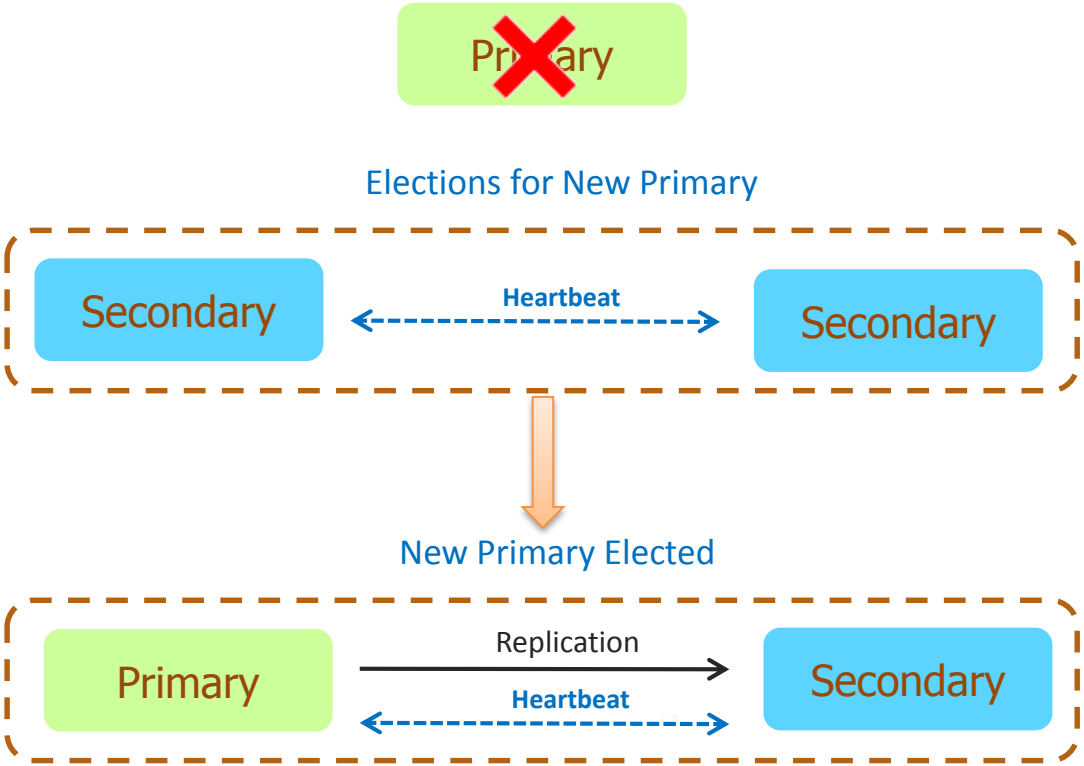


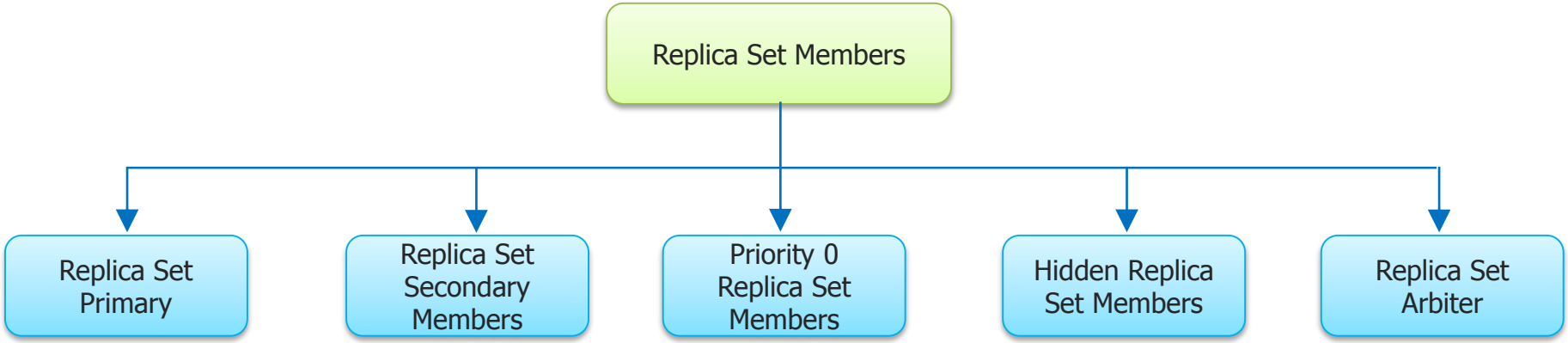
Replication in MongoDB® (Contd.)



Replication in MongoDB® (Contd.)



Replica Set Members



Replication Set Primary and Secondary

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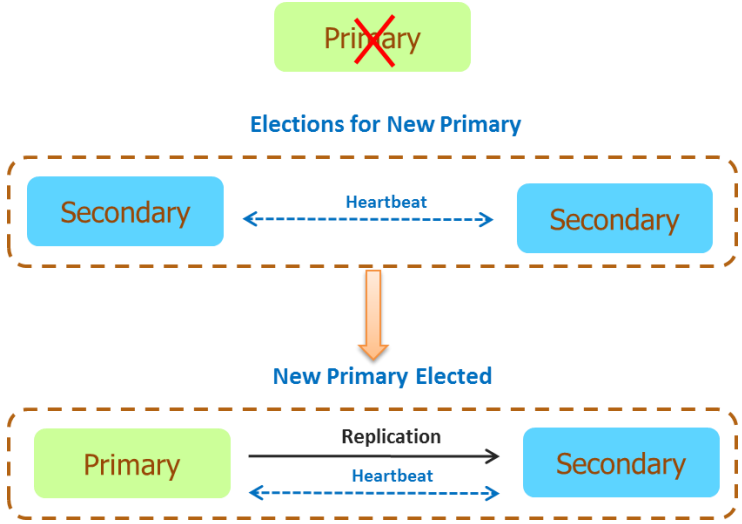
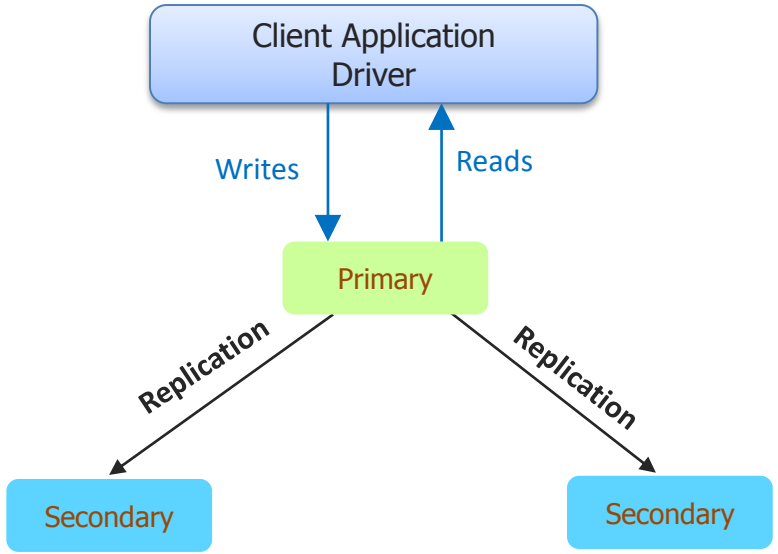
→ The primary is the only member in the replica set that receives write operations.

→ MongoDB® applies write operations on the primary and then records the operations on the primary's oplog.

→ Secondary members replicate this log and apply the operations to their data sets.





Priority 0 Replica Set Members

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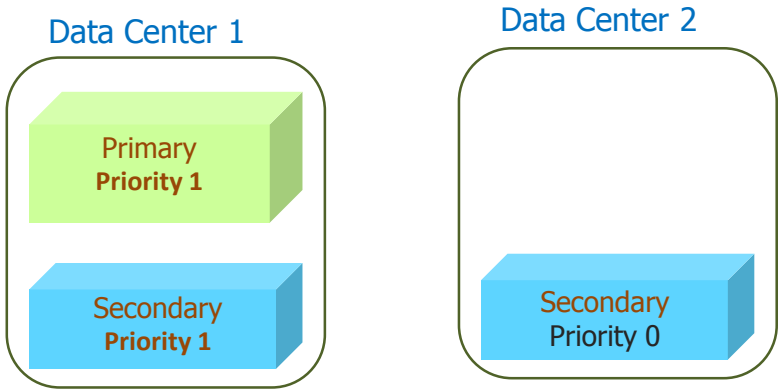
- A priority 0 member is a secondary that cannot become primary.
- Priority 0 members cannot trigger elections. Otherwise these members function as normal secondaries.
- A priority 0 member maintains a copy of the data set, accepts read operations, and votes in elections.
- Configure a priority 0 member to prevent secondary's from becoming primary, which is particularly useful in multi-data center deployments.
- In a three-member replica set, in one data center hosts the primary and a secondary. A second data center hosts one priority 0 member that cannot become primary.



Hidden Replica Set Members

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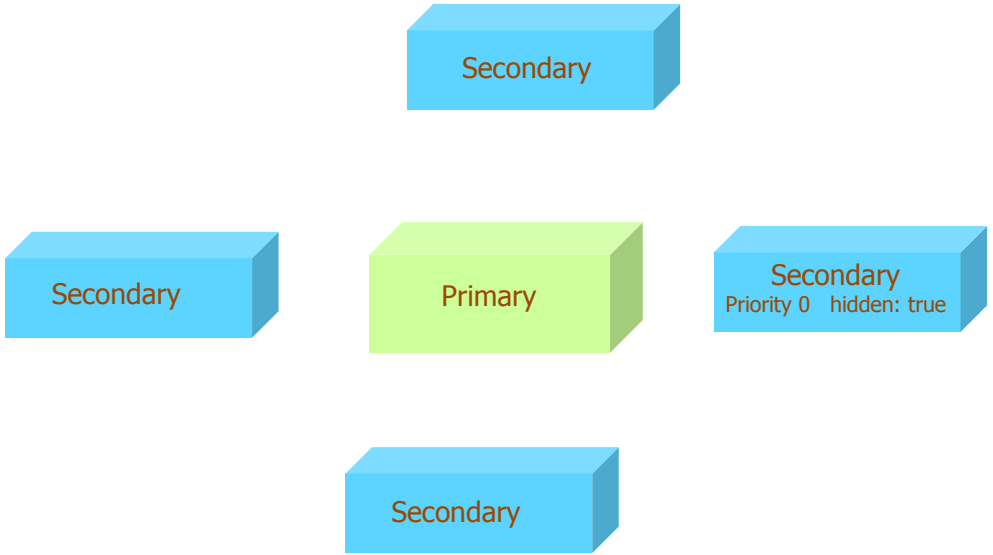
- A hidden member maintains a copy of the primary's data set but is invisible to client applications.
- Hidden members are good for workloads with different usage patterns from the other members in the replica set.
- Hidden members are always priority 0 members and cannot become primary.
- The db.isMaster()method does not display hidden members. Hidden members, however, do vote in elections.
- Use hidden members for dedicated tasks such as reporting and backups.
- Delayed members should be hidden. Hidden members do vote in replica set elections.



Replica Set Arbiter

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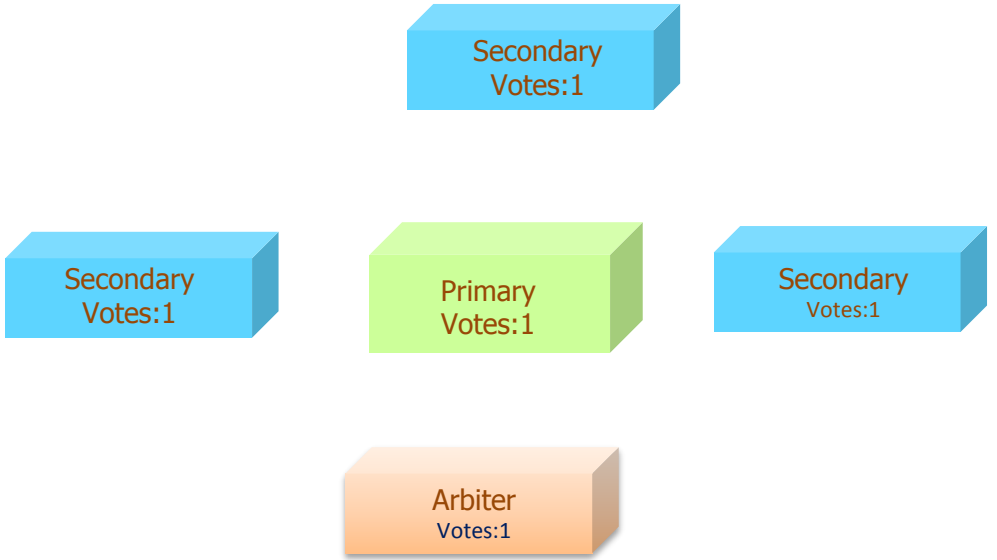
- An arbiter does not have a copy of data set and cannot become a primary.
- Replica sets may have arbiters to add a vote in elections of for primary.
- Arbiters allow replica sets to have an uneven number of members, without the overhead of a member that replicates data.
- Only add an arbiter to sets with even numbers of members.
- If you add an arbiter to a set with an odd number of members, the set may suffer from tied elections.



Annie's Question

How many maximum replica can be there in one replica set?

Annie's Answer

Maximum replica can be 12 in one replica set.

Annie's Question

How long does replica set failover take?

Annie's Answer

- It varies, but a replica set will select a new primary within a minute.
- It may take 10-30 seconds for the members of a replica set to declare a primary inaccessible.

Annie's Question

When do we use master slave replication at the place of replica set?

Annie's Answer

If your deployment requires more than 12 nodes, you must use master/slave replication.

Annie's Question

How many arbiters do replica sets need?

Annie's Answer

Some configurations do not require any arbiter instances. Arbiters vote in elections for primary but do not replicate the data like secondary members.

Annie's Question

Which members of a replica set vote in elections?

Annie's Answer

All members of a replica set, unless the value of votes is equal to 0, vote in elections. This includes all delayed, hidden and secondary-only members, as well as the arbiters.

Replica Set Deployment Architecture

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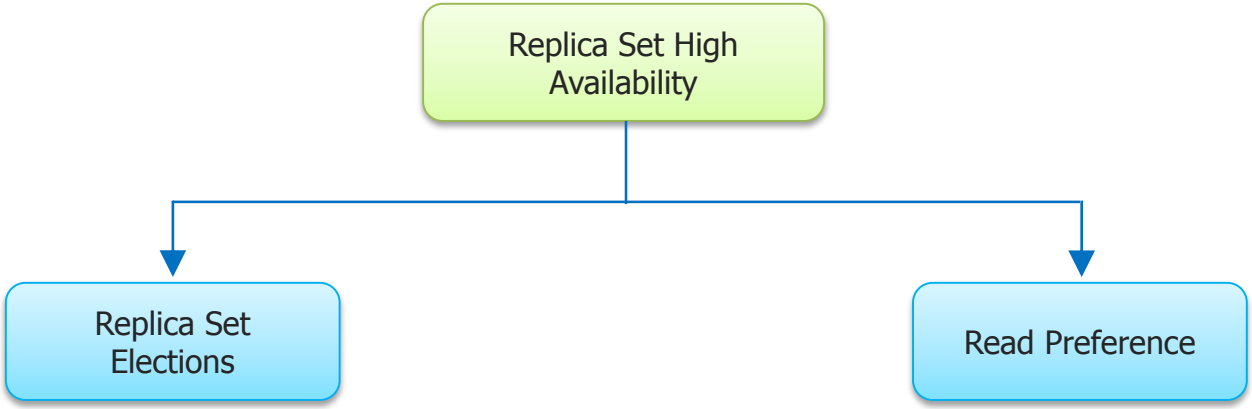
3 Member Replica Set

» Three-member replica sets provide the minimum recommended architecture for a replica set.

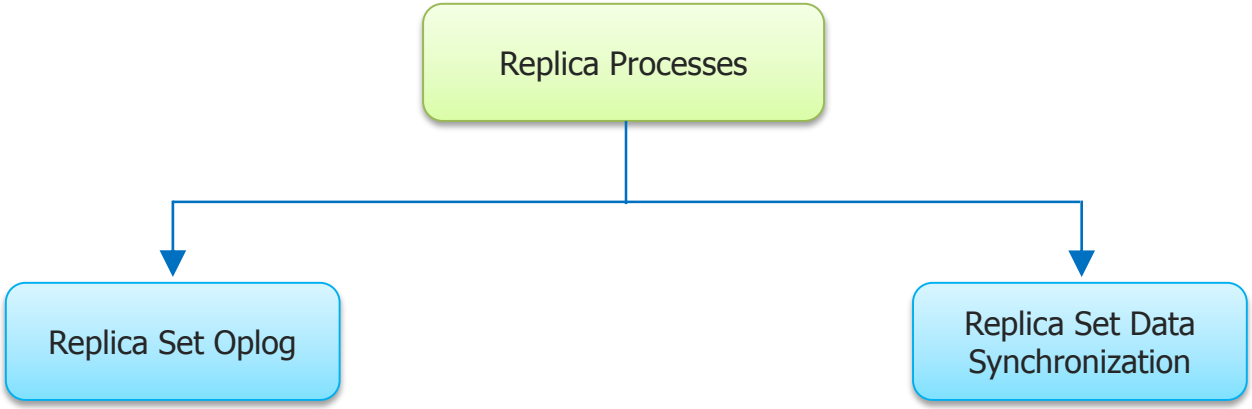
Replica Sets with 4 or More Members

» It provide greater redundancy and can support greater distribution of read operations and dedicated functionality.

Replica Set High Availability



Replica Processes



Replica Set Tutorials

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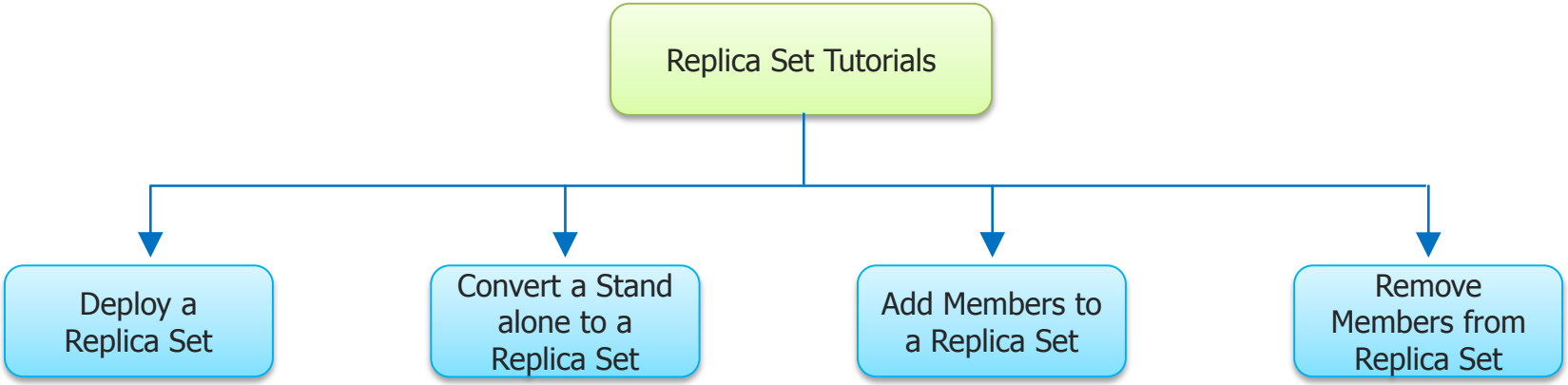


Replica Set Deployment Tutorials

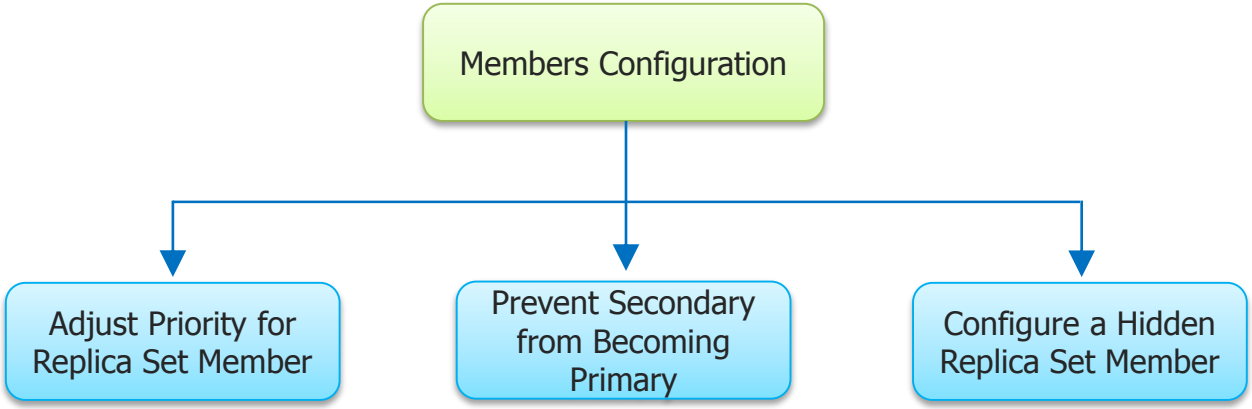
Annie's Question

What is configdb in MongoDB® ?

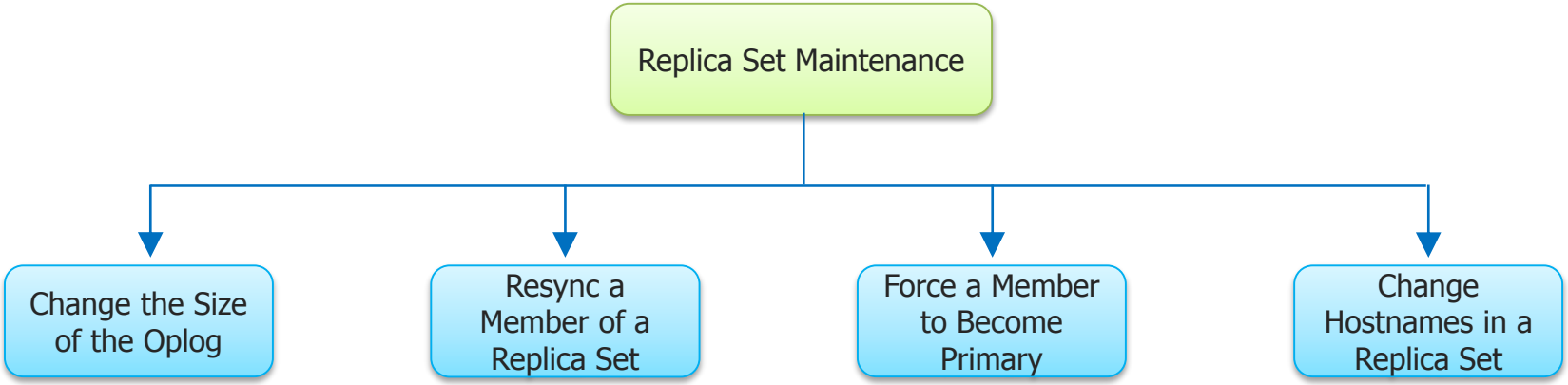
Annie's Answer

It stores metadata of sharded cluster (light weight mongod).

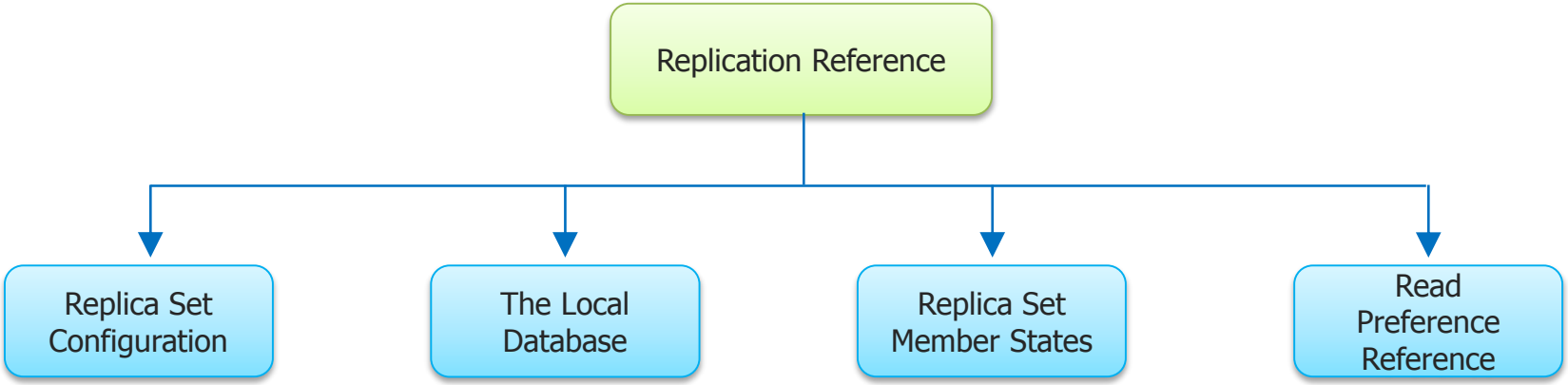
Members Configuration



Replica Set Maintenance



Replication Reference



Sharding

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- → Sharding is the process of storing data records across multiple machines.
- → It provides support to meeting the demands of data growth.
- → As the size of the data increases, a single machine may not be sufficient to store the data nor provide an acceptable read and write throughput.
- → Sharding solves the problem with horizontal scaling.
- → With sharding, we can add more machines to support data growth and the demands of read and write operations.

Why is Sharding?

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→ In replication all writes go to master node.

→ Latency sensitive queries still go to master.

→ Single replica set has limitation of 12 nodes.

→ Memory can't be large enough when active dataset is big.

→ Local Disk is not big enough.

→ Vertical scaling is too expensive.

Sharding Concepts

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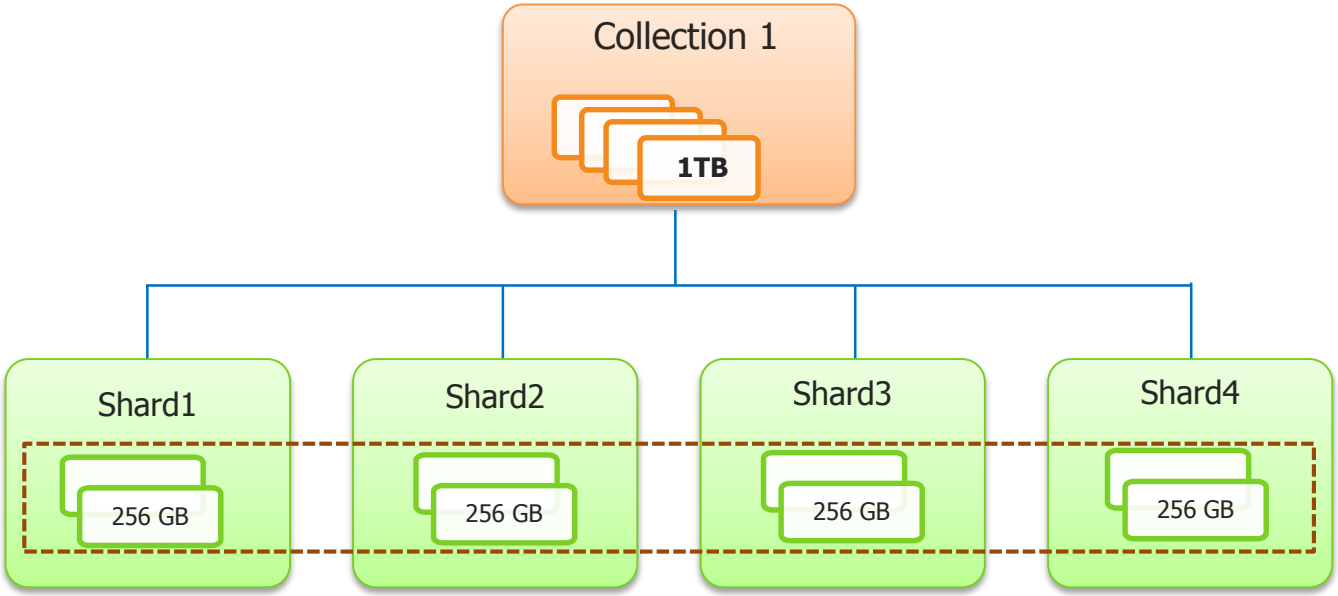
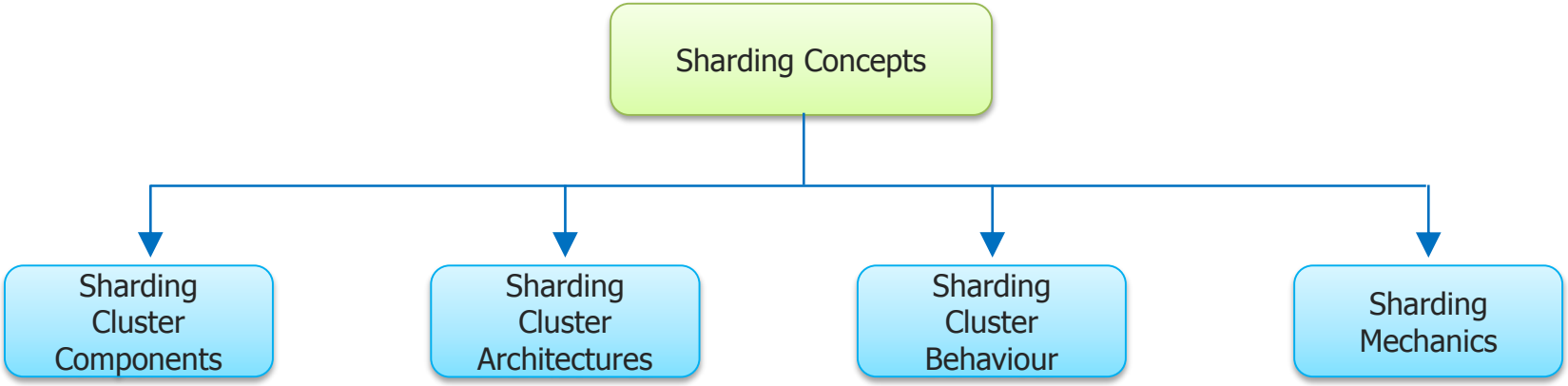


Sharding Concepts (Contd.)



Sharded Cluster Components

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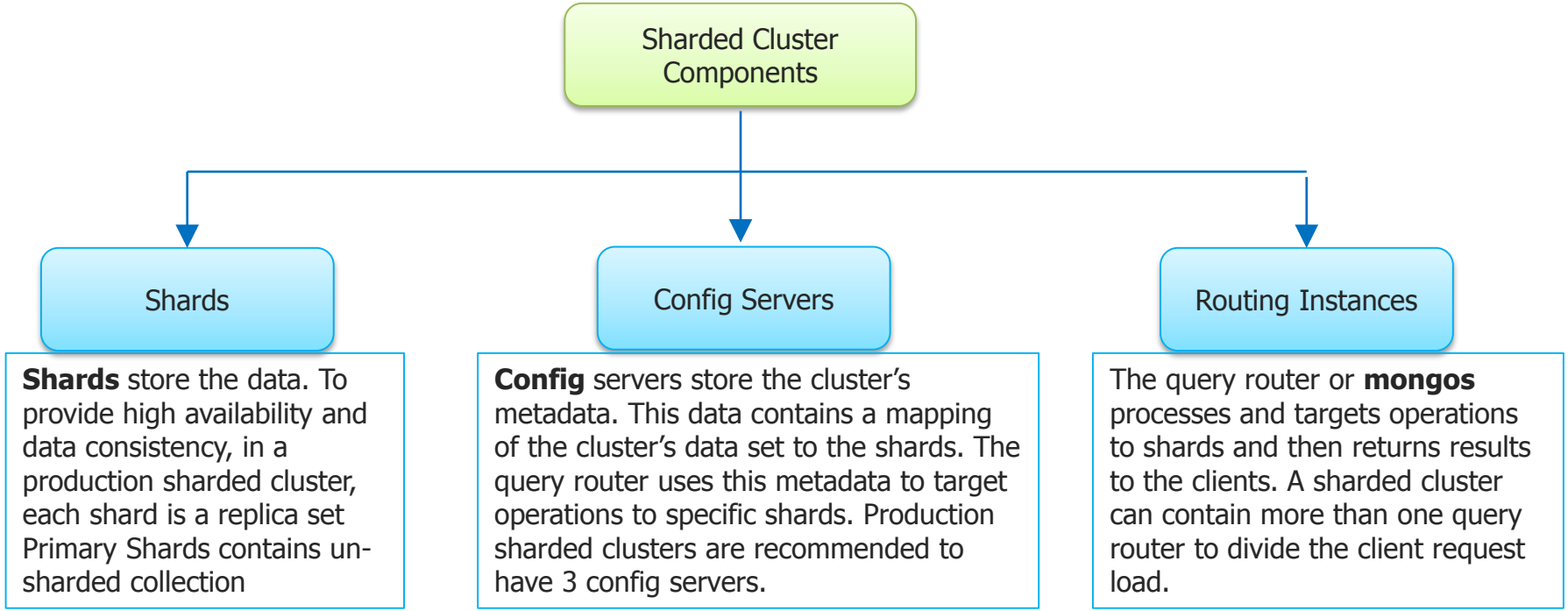
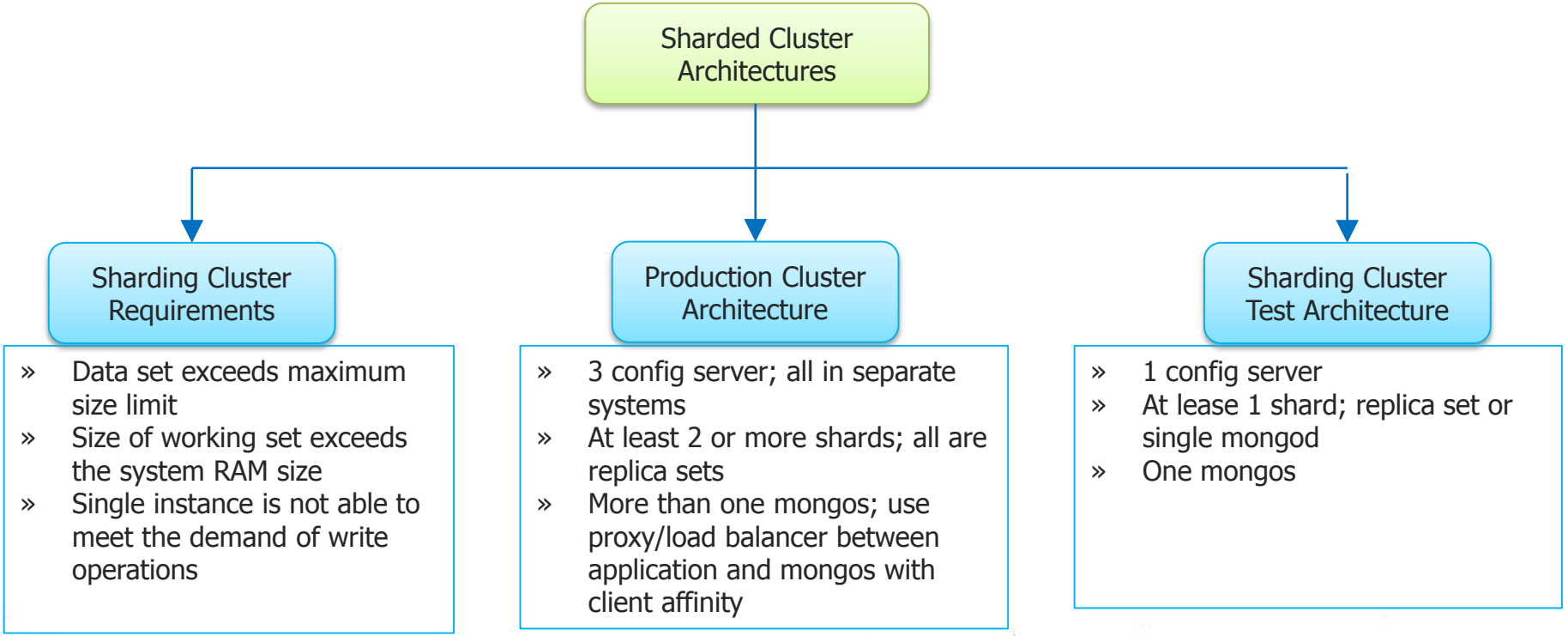


Sharded Cluster Architectures



Sharding Architecture

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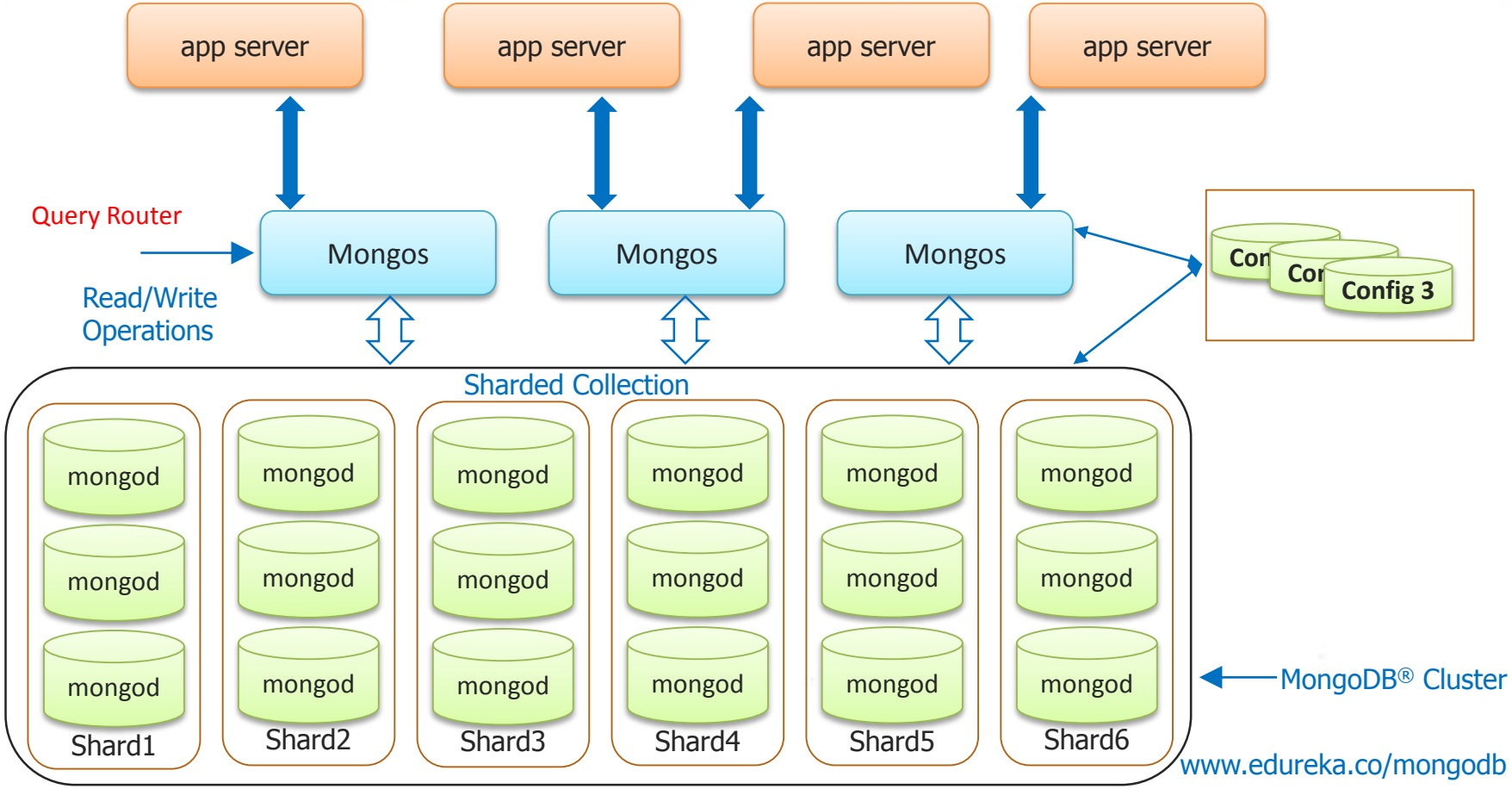

Sharded Cluster Behavior

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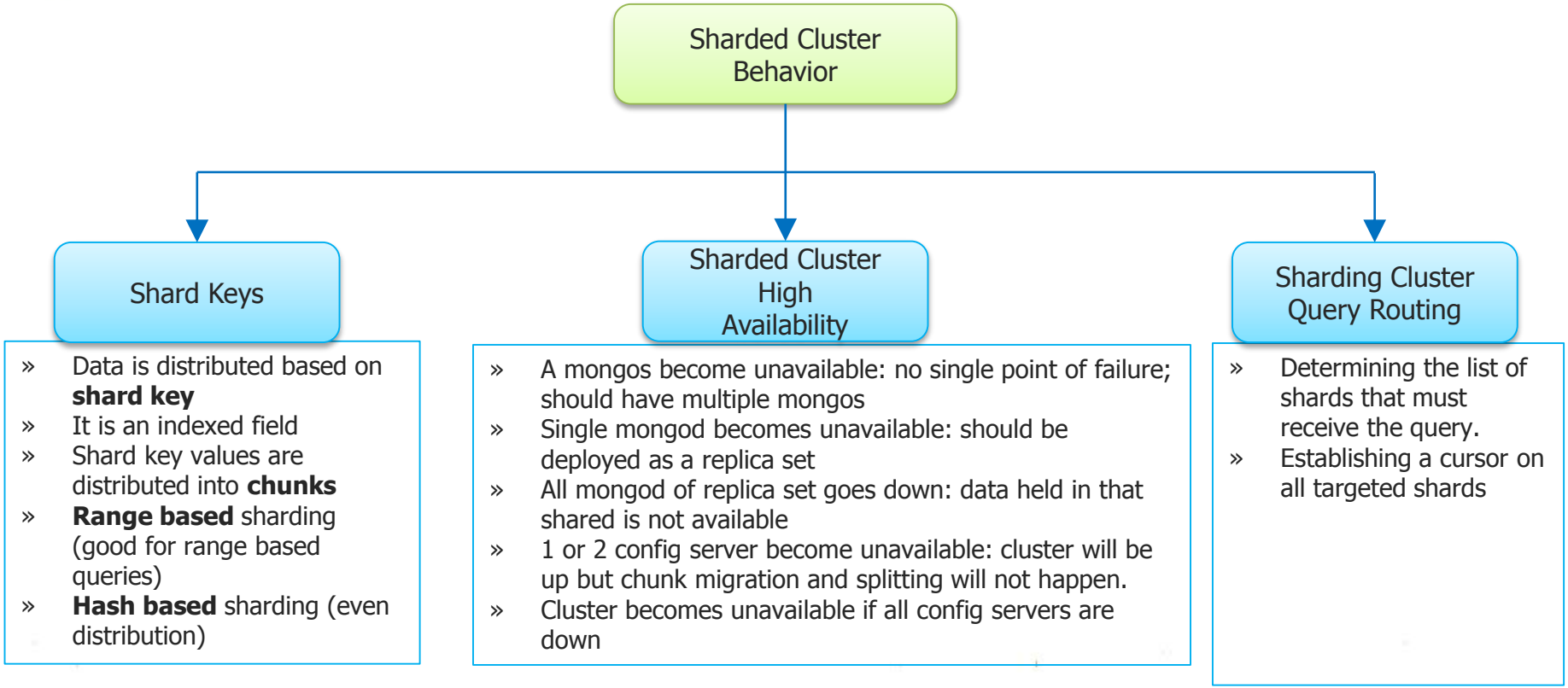
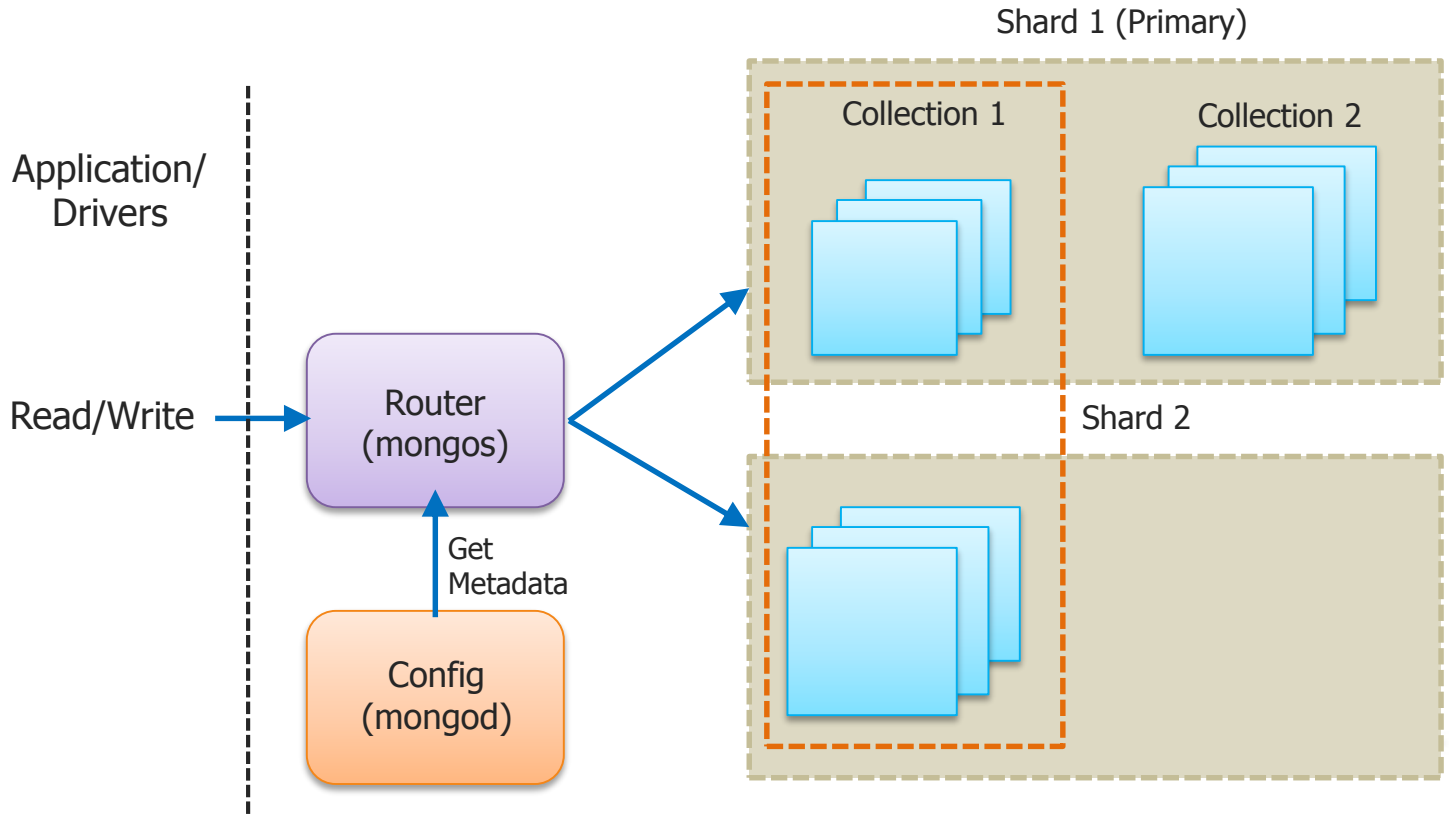
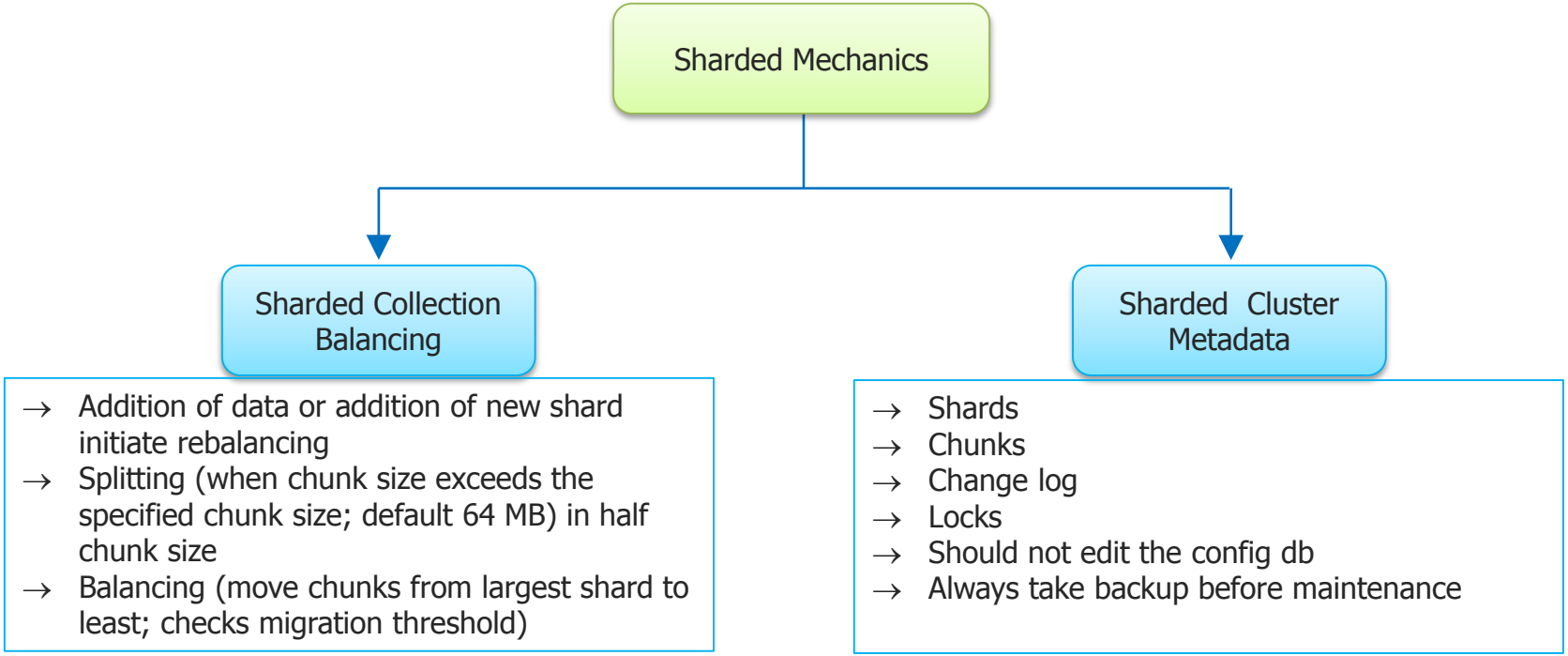


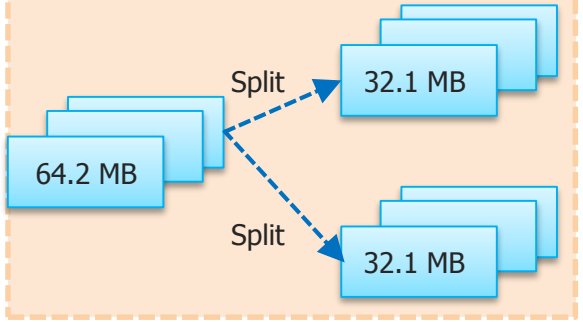
Query Routing



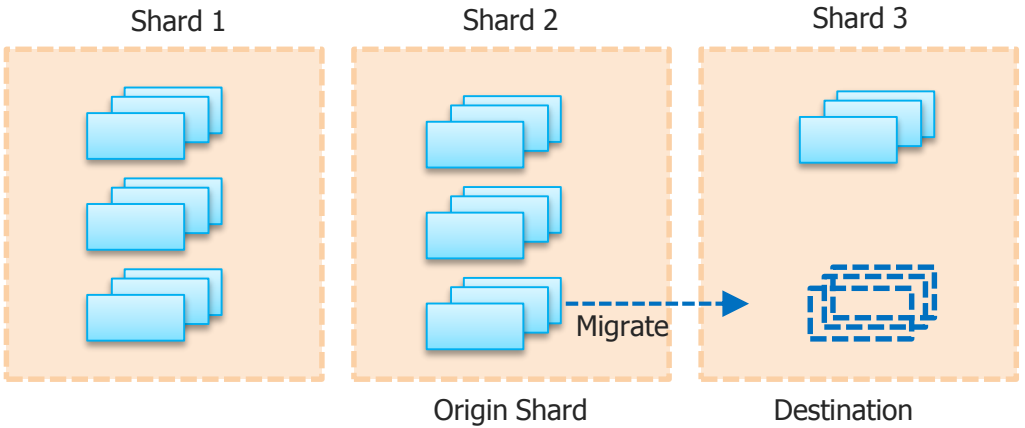
Sharded Mechanics



Splitting and Balancing



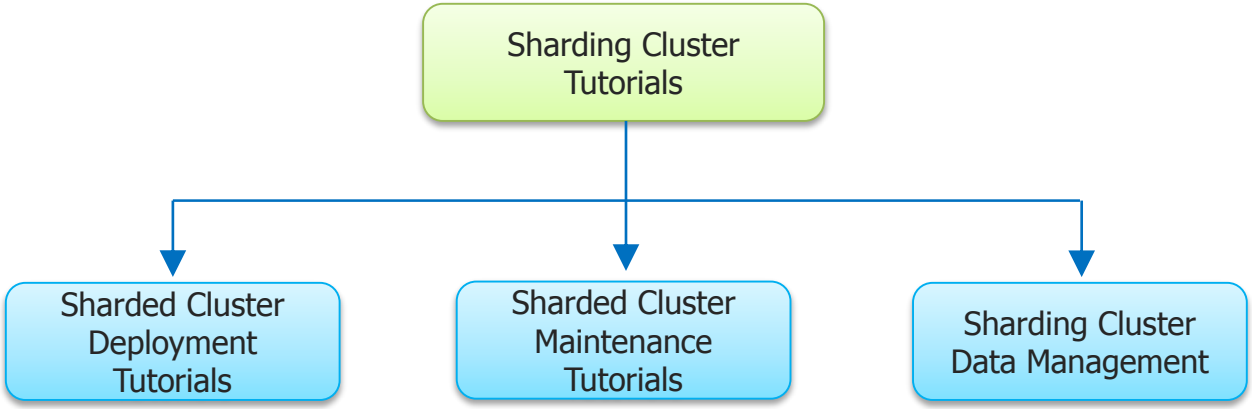
Chunk Splitting through Splitter



Chunk Migration through Balancer

Number of Chunks	Migration Threshold
Fewer than 20	2
21 – 80	4
Greater than 80	8

Sharded Cluster Tutorials



Annie's Question

Can I change the shard key after Sharding a collection?

Annie's Answer

No

Annie's Question

How do we co-relate sharding with RDBM and MongoDB® ?

Annie's Answer

Partitioning or horizontal scaling.

Annie’s Question

What is query router?

Annie's Answer

mongos

Annie's Question

What does config server store?

Annie's Answer

Metadata of the sharded cluster

Annie's Question

What is range based partitioning?

Annie's Answer

MongoDB® divides the data set into ranges determined by the shard key values to provide range based partitioning.

Annie's Question

What is Hash Based Sharding?

Annie's Answer

MongoDB® computes a hash of a field's value, and then uses these hashes to create chunks.

Sharding Hands On

Assignment

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→ Attempt the assignment using document present in LMS.

Pre-work

- Refer replication and sharding documents and configure on your machine
- Read Module 5 FAQ
- Attempt Module 5 Quiz
- Complete assignment

Agenda for Next Module

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- → Index Introduction
- → Index Concepts
- → Index Types
- → Index Properties
- → Index Creation
- → Index Tutorial
- → Indexing Reference
- → Aggregation to Introduction
- → Approach to Aggregation

Survey

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Your feedback is important to us, be it a compliment, a suggestion or a complaint. It helps us to make the course better!

Please spare few seconds to take the survey after the webinar.

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