Paseo Posse – Hyperlocal Delivery System

MongoDB is utilized for its NoSQL capabilities, specifically leveraging sharding and replication to address the requirements of scalability, high availability, and fault tolerance.

Sharding in MongoDB:

Horizontal Scaling:

Sharding in MongoDB enables horizontal scaling by distributing data across multiple servers (shards). This is particularly advantageous for handling the geographical dispersion of data, which is critical in a hyperlocal delivery system where data is partitioned based on ZIP codes.

Sharding Key:

The choice of sharding key, in this case, is ZIPCODE. Sharding based on ZIP codes allows the system to distribute data geographically, improving read and write performance by distributing the data load across multiple shards.

Replication in MongoDB:

High Availability:

MongoDB's replication is employed to achieve high availability and fault tolerance. Each shard in the sharded cluster consists of a three-member PSS (Primary-Secondary-Secondary) replica set. This setup ensures that even if one node fails, there are redundant copies of data on other nodes.

Fault Tolerance:

In the master-slave replication setup, one node serves as the master that accepts write operations, while the other nodes (slaves) replicate data from the master and serve read operations. This redundancy enhances fault tolerance and ensures data availability in case of node failures.

MongoDB Collections:

CUSTOMER_DETAILS Collection:

Denormalization Technique: Storing the last 4 orders directly in the customer document optimizes read operations for common use cases, such as viewing recent order history. This denormalization is a trade-off between read and write efficiency, aiming to improve performance for frequently accessed data.

Example entry:

Customer Name	Email	Phone Number	Full Address	Postal Code	Country
Horace Chillingworth	hchillingworth2@alexa.com	699-670-1287	93098 Birchwood Avenue, Anqing, Arizona	85201	United States
Quincy Archdeckne	qarchdeckne5@ning.com	597-511-4159	780 Cherokee Pass, Adiaké, Arizona	85201	United States
Natividad Sheavills	nsheavillsd@auda.org.au	524-869-5077	47323 Canary Avenue, Sijiu, Arizona	85201	United States
Theo Wiltshear	twiltshearh@de.vu	733-220-0756	962 Sommers Court, Baoshan, Arizona	85201	United States
Gherardo Shand	gshandn@aol.com	555-885-1790	92 Elgar Alley, Atbasar, Arizona	85201	United States
Celka Edgecumbe	cedgecumbeo@drupal.org	976-935-7556	47117 Bunting Avenue, Zapolyarnyy, Arizona	85201	United States
Aurora Andrichak	aandrichaku@list-manage.com	334-311-8672	88861 Rowland Hill, Medaya, Arizona	85201	United States
Gaby Letty	glettyx@bizjournals.com	930-692-3714	349 Texas Junction, Waihai, Arizona	85201	United States
Darice Christoforou	dchristoforou17@upenn.edu	741-506-2575	7791 Buena Vista Avenue, Danao, Arizona	85201	United States
Rik Brough	rbrough1a@jigsy.com	771-483-8135	68767 Fallview Point, Kanal, Arizona	85201	United States
Rhodia Caldes	rcaldes1s@de.vu	225-671-0158	2 Hanson Drive, Baton Rouge, Arizona	85201	United States
Keenan Haughton	khaughton24@people.com.cn	479-705-5358	87 Loomis Circle, Bacong, Arizona	85201	United States
Marcile Van der Krui	mvanderkrui2f@ustream.tv	521-218-5934	8996 Havey Alley, Obubra, Arizona	85201	United States

Order Type	Order ID	Status	Items
Recent	9733	FAILED	Medicine ID: 5, Quantity: 14, Medicine ID: 46, Quantity: 7
Recent	9729	FAILED	Medicine ID: 83, Quantity: 32, Medicine ID: 13, Quantity: 30, Medicine ID: 55, Quantity: 12, Medicine ID: 42, Quantity: 9, Medicine ID: 39, Quantity: 37
Recent	9760	PROCESSED	Medicine ID: 61, Quantity: 37, Medicine ID: 29, Quantity: 3, Medicine ID: 24, Quantity: 31, Medicine ID: 26, Quantity: 40
Recent	9784	FAILED	Medicine ID: 40, Quantity: 30, Medicine ID: 78, Quantity: 6, Medicine ID: 61, Quantity: 11, Medicine ID: 14, Quantity: 21

MEDICINE_DETAILS Collection:

Stores static information about medicines, including ID, name, and price. This collection is essential for maintaining details about the available medicines in the system.

Example entry:

Medicine ID	Medicine Name	Drug	Company	Price	Total Demand	Successful Orders
15	Clopidogrel Bisulfate	Loxapine	REMEDYREPACK INC.	89.33	280	70

WAREHOUSE_DETAILS Collection:

Stores details about warehouses, including their ID, name, and ZIP code. This collection helps manage the distribution and availability of goods across different warehouses.

Replication for High Availability:

Objective:

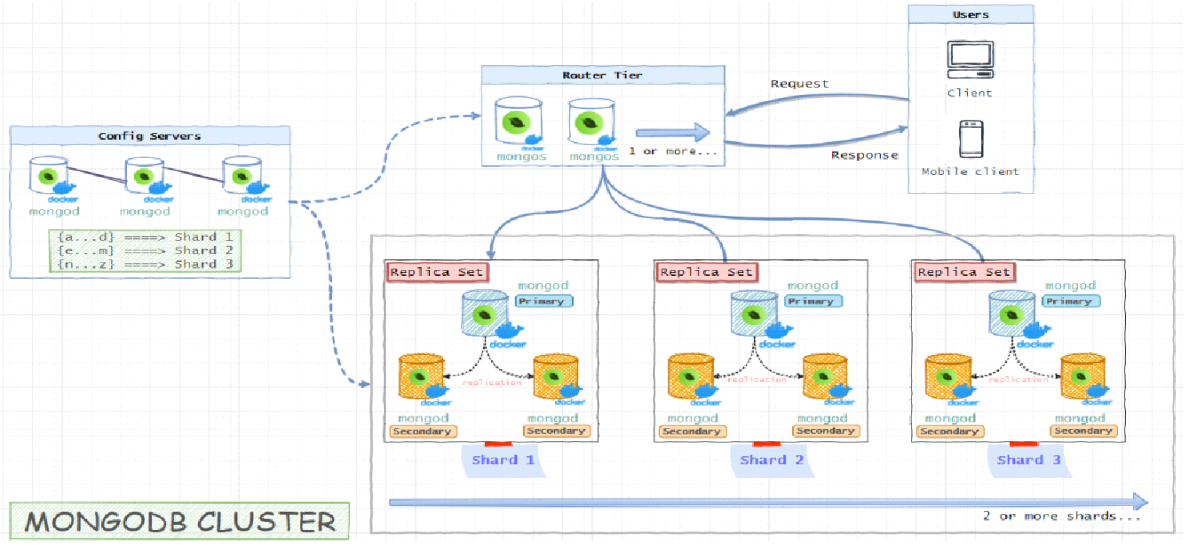
MongoDB's replication is used to enhance high availability and fault tolerance. Replication maintains multiple copies of data across different servers, ensuring data availability even in the event of node failures.

Replication Setup:

The MongoDB sharded cluster includes a configuration server replica set and three shards, each comprising a three-member PSS (Primary-Secondary-Secondary) replica set. This architecture provides redundancy and fault tolerance.

Fault Tolerance:

The replication setup ensures that even if a node fails, data remains available, and the system can continue operations without significant disruptions.



Mongodb replicated slaves can be further used to perform analysis as follows:

```
pratyushpandey@Pratyushs-Air part-5 % python3 mongo_CRUD.py
Total revenue generated for successful orders: 617498.07
Total revenue loss for status false orders: 977497.38
Top 5 medicines sold:
+-------------+-----------------------------------+----------------------+------------+
| Medicine ID |           Medicine Name           |         Drug         | Total Sold |
+-------------+-----------------------------------+----------------------+------------+
|      11     |                LBEL               |        Avelox        |    472     |
|      75     |              Top Care             | leader pain and fever |    403     |
|      2      | SaniSuds Foam Instant Hand Sanitizer |   Gentamicin Sulfate  |    398     |
|      47     |        Hydrochlorothiazide        |      Topiramate      |    386     |
|      4      |        Nighttime Sleep Aid        |      Nevirapine      |    384     |
+-------------+-----------------------------------+----------------------+------------+
Bottom 5 medicines sold:
+-------------+-----------------------------------------------------------+-----------------------------------+------------+
| Medicine ID |                       Medicine Name                       |                Drug               | Total Sold |
+-------------+-----------------------------------------------------------+-----------------------------------+------------+
|      76     | Promethazine hydrochloride and phenylephrine hydrochloride |          Thyro T3 Rescue          |     89     |
|      74     |                         Lisinopril                        |       Clearasil Daily Clear       |     92     |
|      71     |                         RETROVIR                          | Hada Labo Tokyo Protecting Day SPF 30 |    110     |
|      52     |                         Paclitaxel                        |             Xylocaine             |    114     |
|      28     |                         Iophen C NR                       |             Candida I             |    120     |
+-------------+-----------------------------------------------------------+-----------------------------------+------------+
```