Project 2

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Online Master of Science in Data Science, Merrimack College

DSE6210: Big DataL SQL and NoSQL

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Part 1:


```
{
  "flight_number": "FL123",
  "airline_code": "FA",
  "aircraft_type": "Jet",
  "origin": {
    "airport_code": "A1",
    "airport_name": "Alpha Airport",
    "location": "City A"
  },
  "destination": {
    "airport_code": "B2",
    "airport_name": "Beta Airport",
    "location": "City B"
  },
  "departure_date_time": "2024-12-01T08:00:00Z",
  "arrival_date_time": "2024-12-01T11:00:00Z",
  "legs": [
    {
      "leg_id": 1,
      "origin_airport": "A1",
      "destination_airport": "C3",
      "actual_departure_time": "2024-12-01T08:00:00Z",
      "actual_arrival_time": "2024-12-01T09:30:00Z"
    },
    {
      "leg_id": 2,
      "origin_airport": "C3",
      "destination_airport": "B2",
      "actual_departure_time": "2024-12-01T10:30:00Z",
      "actual_arrival_time": "2024-12-01T11:00:00Z"
    }
  ],
  "reservations": [
    {
      "reservation_id": 1,
      "passenger": {
        "passenger_id": 101,
        "first_name": "Alice",
        "last_name": "Smith",
```

```
            "contact": {
                "phone": "000-000-0000",
                "email": "alice@example.com"
            },
            "address": {
                "city": "City A",
                "state": "State A",
                "country": "Country A"
            }
        },
        "reservation_status": "confirmed",
        "ticket_type": "one-way",
        "travel_class": "economy",
        "payment": {
            "payment_id": 1,
            "status": "paid",
            "amount": 200.00,
            "date": "2024-11-15T10:00:00Z"
        }
    }
  ]
}
```

Part 2:

MongoDB's document model offers key advantages for an airline reservation system. By storing all related data, such as passenger details and reservation information, within a single document, MongoDB reduces the need for complex joins, resulting in faster data retrieval. This efficiency is beneficial for operations like checking flight schedules and reservations, where speed is critical to user satisfaction (Tarud).

Additionally, MongoDB's support for indexing further enhances performance, making it an effective choice for read-heavy applications (MongoDB). The flexibility of MongoDB is another advantage. Its schema-less design allows the database to adapt quickly as the structure of flight data evolves, which is essential for handling dynamic data like new flight routes or changes in reservation policies (Tarud). This flexibility is complemented by MongoDB's ability to scale horizontally through sharding, making it capable of managing large volumes of bookings and expanding data needs without significant downtime (MongoDB). As a result, MongoDB can support the growth of applications that must scale quickly to accommodate increasing user demand.

However, there are potential drawbacks to using a document model like MongoDB. Embedding data within documents can lead to data redundancy. For example, passenger contact information might be repeated across multiple reservations, requiring multiple updates if changes are needed (Tarud). Additionally, ensuring data consistency across multiple documents can be challenging since MongoDB lacks the same level of transactional support as traditional RDBMS (MongoDB). Managing such consistency requires careful design, such as using two-phase commits or designing for eventual consistency.

Deciding between an RDBMS like PostgreSQL and MongoDB depends on the needs of the airline system. RDBMS is ideal for maintaining data integrity and handling complex transactions, such as ticket cancellations, due to its support for ACID properties (MongoDB) In contrast, MongoDB's scalability and flexibility make it a strong candidate for managing dynamic and large-scale data like real-time flight updates (MongoDB). A hybrid approach, using MongoDB for flexible data storage and RDBMS for transactional consistency, can offer a balanced solution that caters to both scalability and reliability (Tarud).

Citations

1. “MongoDB Features & Key Characteristics.” *MongoDB*, www.mongodb.com/resources/products/capabilities/features. Accessed 18 Oct. 2024.
2. Project 1 Paper, Hibah Masoom
3. SRS Project 2
4. Tarud, Jonathan. “MongoDB: Advantages and Disadvantages You Should Consider.” *Koombea*, Koombea, 6 Aug. 2024, www.koombea.com/blog/mongodb-advantages-and-disadvantages/.