

MongoDB Case Study

Objectives

By the end of this session, you should be able to:

- ☐ Introduction
- ☐ Fair Bay City Council
- ☐ Fair Bay City Bikes
- ☐ Technical Discussions and Decisions
- ☐ Database Design
- ☐ Use Cases

Introduction

- ❑ For any tool or technology that you choose to learn, it is important to learn how it is used.
- ❑ A study on use case of an imaginary city council and their upcoming bike-sharing project will be done.
- ❑ Details of the project and see why it is needed; the requirements and how MongoDB can solve their problem.

Fair Bay City Council

- ❑ Fair Bay is a city located on the east coast of North Roseland and is traditionally known for its pleasant climate and historical significance.
- ❑ The city is expanding at a fast pace, and the local city council is working hard to assess and redevelop the city's basic infrastructure and facilities to maintain its ease of living index.
- ❑ In past assessments and surveys, the following concerns were repeatedly raised by the residents of the local communities:
 - Local transport is always crowded.
 - There is frequent traffic congestion.
 - Fuel and parking prices are rising.
 - There is bad air quality in the central parts of the city.
 - Commute times are increasing.

Fair Bay City Council

- ❑ To resolve these complaints, the council invites corporates, start-ups, and even the public to come forward with smart and innovative ideas and related project proposals.
- ❑ One of the local start-ups has proposed a rollout of Fair Bay City Bikes, which is an online bike-sharing platform.
- ❑ Besides being a unique, innovative solution, it is also one of the most environmentally friendly project proposals.

Fair Bay City Bikes

- ❑ A bike-sharing program is a sustainable way of traveling for several reasons. It provides a healthier and cheaper mode of transportation than using cars, public transport, or private bikes.
- ❑ Typically, the booking and tracking of the bikes are controlled via an online platform.
- ❑ Studies and surveys have concluded that a well-implemented bike-sharing program can
 - Reduce traffic congestion
 - Improve air quality
 - Reduce car and public transport usage
 - Help people save money spent on other vehicles
 - Encourage healthier lifestyles
 - Improve the sense of community

Fair Bay City Bikes

- ❑ Next, we will look at some of the major highlights of their proposal.

Proposal Highlights

- Dockless Bikes
- Ease of Use
- Real-Time Tracking
- Maintenance and Care

Technical Discussions and Decisions

- ❑ The council has insisted that the team keep the IT infrastructure cost to a minimum, reduce the overall rollout time, and build a scalable and flexible system for future requirement changes.
- ❑ The technical team at the start-up did some research to address these conditions as
 - **Quick Rollout**
 - **Cost Effective**
 - **Flexible**

Database Design

- ❑ The three basic entities to be persisted are **user**, **vehicle**, and **ride**.
- ❑ The **user** and **vehicle** entities will store the attributes of users and vehicles respectively, while the **ride** entity will be created whenever a new ride is commenced.
- ❑ Apart from the basic entities, an additional entity is needed to track the bike ride logs.
- ❑ For each active ride, the system captures and logs the bike's location.
- ❑ The logs will be used for reporting and analytics purposes.
- ❑ Because of the document-based dataset offered by MongoDB, all the entities can easily be designed as collections.

Users

- ❑ The **users** collection holds data for all who have registered in the system. The following code snippet shows a sample document that represents one of the registered users:

```
{
  "_id" : "a6e36e30-41fa-45bf-93c5-83da4efeed37", "email_address" :
  "ethel.112@example.com", "first_name" : "Ethel",
  "last_name" : "Carter",
  "date_of_birth" : ISODate("1993-06-01T00:00:00Z"), "address" : {
    "street" : "51 Thornridge Cir", "city" : "Fair Bay",
    "state" : "North Roseland", "post_code" : 9924, "country" : "Roseland"
  },
  "registration_date" : ISODate("2020-11-24T00:00:00Z"), "id_documents" : [
    {
      "drivers_license" : { "license_number" : 2771556252,
        "issue_date" : ISODate("2011-04-18T00:00:00Z")
      }
    }
  ],
  "payments" : [
    {
      "credit_card" : {
        "name_on_card" : "Ethel Carter", "card_number" : 342610644867494,
        "valid_till" : "3/22"
      }
    }
  ]
}
```

- ❑ The **vehicles** collection represents the bikes in the fleet. City Bikes will have 200 bikes initially. The structure of a vehicle document with all the fields and example values is shown in the following snippet

```
{
  "_id" : "227fe7e0-76c7-410b-afe8-6ae5785ac937", "vehicle_type" :
  "bike|scooter",
  "status" : "available",
  "rollout_date" : ISODate("2020-10-20T00:00:00Z"), "make" : {
  "Manufacturer" : "Compass Cycles",
  "model_name" : "Unisex - Flatbar Carbon Frame Road Bike", "model_code" :
  "CBUFLATR101",
  "year" : 2020,
  "frame_number" : "FWJ166K23683958E"
  },
  "gears" : 3, "has_basket" : true, "has_helmet" : true,
  "bike_type" : "unisex|men|women", "location" : {
  "type" : "Point", "coordinates" : [
  111.189631,
  ]
  },
  "last_maintenance_date" : ISODate("2020-11-
  05T00:00:00Z")
}
```

Rides

- ❑ The **rides** collection represents the trips, and the total number of documents in this collection denotes the number of rides taken through the system:

```
{
  "_id" : "ebe89a65-ee02-4fa8-aba7-88c33751d487", "user_id" : "a6e36e30-41fa-
45bf-93c5-83da4efeed37", "vehicle_id" : "227fe7e0-76c7-410b-afe8-
6ae5785ac937", "start_time" : ISODate("2020-11-25T02:10:00Z"),
"start_location" : { "type" : "Point", "coordinates" : [
111.189631,
-72.454577
]
},
"end_time" : ISODate("2020-11-25T03:17:00Z"),
"end_location" : { "type" : "Point", "coordinates" : [ 111.045789,
-72.456144
]
},
"feedback" : {
  "stars" : 5,
  "comment" : "Navigation helped me locate the bike quickly, enjoyed my
ride. Thank you City Bikes"
}
}
```

Use Cases

- ☐ **User Finds Available Bikes**
- ☐ **User Unlocks a Bike**
- ☐ **User Locks the Bike**
- ☐ **System Logs the Geographical Coordinates of Rides**
- ☐ **System Sends Bikes for Maintenance**
- ☐ **Technician Performs Fortnightly Maintenance**

Generating Stats

- ☐ The analysts are tasked with using the various stats generated by the app to identify areas of improvement and optimization as well as to assess the system benefits in terms of the money being spent.

Summary

- ❑ In this session, you learned about:
- ❑ City Bikes project implemented by an imaginary city council.
- ❑ Using a MongoDB Atlas-based **Database-as-a-Service (DBaaS)** solution to address all the issues.
- ❑ Various features and benefits of MongoDB through practical examples and applications.
- ❑ The benefits offered by its JSON-based data structure and flexible schema.
- ❑ The core database operations and operators to find, aggregate, insert, update, and delete data from collections, as well as more advanced concepts such as performance improvement, replication, backup and restore, and data visualization.