

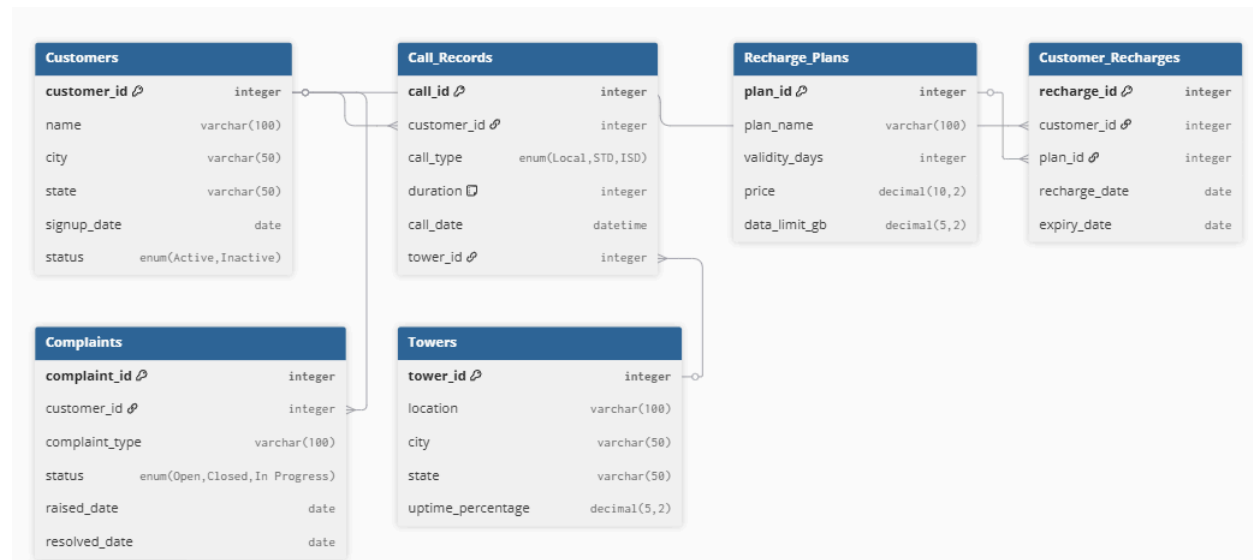
# Day 4: Telecom Domain

## Real-world Context

A telecom company tracks **customers, call records, recharge plans, tower connectivity, and complaints.**

Analysts use this data for churn prediction, service optimization, and network performance improvement.

## Database Schema: TelecomDB



### 1 Customers

```
CREATE TABLE Customers (  
  customer_id INT PRIMARY KEY,  
  name VARCHAR(100),  
  city VARCHAR(50),  
  state VARCHAR(50),  
  signup_date DATE,  
  status ENUM('Active', 'Inactive')
```

```
);
```

## 2 Call\_Records

```
CREATE TABLE Call_Records (  
    call_id INT PRIMARY KEY,  
    customer_id INT,  
    call_type ENUM('Local', 'STD', 'ISD'),  
    duration INT, -- in seconds  
    call_date DATETIME,  
    tower_id INT,  
    FOREIGN KEY (customer_id) REFERENCES Customers(customer_id)  
);
```

## 3 Recharge\_Plans

```
CREATE TABLE Recharge_Plans (  
    plan_id INT PRIMARY KEY,  
    plan_name VARCHAR(100),  
    validity_days INT,  
    price DECIMAL(10,2),  
    data_limit_gb DECIMAL(5,2)  
);
```

## 4 Customer\_Recharges

```
CREATE TABLE Customer_Recharges (  
    recharge_id INT PRIMARY KEY,  
    customer_id INT,  
    plan_id INT,  
    recharge_date DATE,
```

```
    expiry_date DATE,  
    FOREIGN KEY (customer_id) REFERENCES Customers(customer_id),  
    FOREIGN KEY (plan_id) REFERENCES Recharge_Plans(plan_id)  
);
```

## 5 Complaints

```
CREATE TABLE Complaints (  
    complaint_id INT PRIMARY KEY,  
    customer_id INT,  
    complaint_type VARCHAR(100),  
    status ENUM('Open', 'Closed', 'In Progress'),  
    raised_date DATE,  
    resolved_date DATE NULL,  
    FOREIGN KEY (customer_id) REFERENCES Customers(customer_id)  
);
```

## 6 Towers

```
CREATE TABLE Towers (  
    tower_id INT PRIMARY KEY,  
    location VARCHAR(100),  
    city VARCHAR(50),  
    state VARCHAR(50),  
    uptime_percentage DECIMAL(5,2)  
);
```



## Sample Data

INSERT INTO Customers VALUES

(1, 'Alice', 'Delhi', 'Delhi', '2022-03-10', 'Active'),  
(2, 'Bob', 'Mumbai', 'Maharashtra', '2021-11-20', 'Active'),  
(3, 'Charlie', 'Chennai', 'Tamil Nadu', '2020-08-05', 'Inactive'),  
(4, 'David', 'Kolkata', 'West Bengal', '2023-01-15', 'Active'),  
(5, 'Eve', 'Pune', 'Maharashtra', '2023-07-25', 'Active');

INSERT INTO Recharge\_Plans VALUES

(1, 'Daily Data Pack', 28, 199.00, 1.5),  
(2, 'Monthly Unlimited', 84, 599.00, 2.0),  
(3, 'ISD Saver', 56, 299.00, 0.5),  
(4, 'Talktime Booster', 30, 99.00, 0.0);

INSERT INTO Customer\_Recharges VALUES

(1, 1, 2, '2024-06-01', '2024-08-24'),  
(2, 2, 1, '2024-07-15', '2024-08-12'),  
(3, 3, 4, '2023-12-01', '2023-12-31'),  
(4, 4, 3, '2024-10-01', '2024-11-26'),  
(5, 5, 2, '2024-08-05', '2024-10-28');

INSERT INTO Towers VALUES

(101, 'Connaught Place', 'Delhi', 'Delhi', 98.5),  
(102, 'Andheri', 'Mumbai', 'Maharashtra', 97.2),  
(103, 'Guindy', 'Chennai', 'Tamil Nadu', 95.8),  
(104, 'Salt Lake', 'Kolkata', 'West Bengal', 99.0),  
(105, 'Baner', 'Pune', 'Maharashtra', 96.9);

INSERT INTO Call\_Records VALUES

(1, 1, 'Local', 180, '2024-10-01 09:10:00', 101),  
(2, 1, 'STD', 240, '2024-10-02 13:45:00', 101),  
(3, 2, 'Local', 300, '2024-10-05 19:20:00', 102),  
(4, 3, 'ISD', 600, '2024-09-30 22:00:00', 103),  
(5, 5, 'STD', 150, '2024-10-12 17:15:00', 105),  
(6, 4, 'Local', 400, '2024-10-11 08:45:00', 104);

```
INSERT INTO Complaints VALUES
(1, 1, 'Network Issue', 'Closed', '2024-09-20', '2024-09-21'),
(2, 2, 'Billing Error', 'Open', '2024-10-10', NULL),
(3, 3, 'Slow Internet', 'Closed', '2024-09-01', '2024-09-03'),
(4, 4, 'Call Drop', 'In Progress', '2024-10-15', NULL);
```

## 5 SQL Questions

### (Easy)

**Q1:** List all active customers and their latest recharge plan name.

✓ *Hint:* Use `JOIN` between `Customers` , `Customer_Recharges` , and `Recharge_Plans` .

### (Medium)

**Q2:** Find the average call duration (in minutes) by call type for each city.

✓ *Hint:* Join `Call_Records` → `Customers` → `GROUP BY call_type, city` .

### (Hard)

**Q3:** Retrieve the top 2 towers with the lowest uptime percentage.

✓ *Hint:* Use `ORDER BY uptime_percentage ASC LIMIT 2` .

### (Difficult)

**Q4:** Identify customers who have raised more than 1 complaint or have at least one unresolved complaint.

✓ *Hint:* Use `GROUP BY` and a conditional filter on `status != 'Closed'` .

### (Expert)

**Q5:** Find the top 3 customers by **total call duration in October 2024**, along with their **city and plan name** if they have an active plan in that month.

✓ *Hint:* Combine aggregation on `Call_Records` , joins with `Customer_Recharges` , and a date range condition.

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## ⚡ Optimization / Real-World Tips

- Add **indexes** on `(customer_id)` , `(call_date)` , `(plan_id)` , and `(tower_id)` to improve query speed.
- For large-scale telecom data, use **partitioning on call\_date** or **sharding by city/state**.
- In production, **denormalized call summary tables** (daily aggregates) improve analytics query time.