CALCUTTA UNIVERSITY

Name :- Debottam Kar

Semester :- II

Roll :- 11

Department :- Msc computer science & Engineering

Subject :- Advance DBMS

Assignment Topic :-

Evolution of Relational to object and object-Relational Data Model.

Assignment: Evolution from Relational to Object and Object Relational Data Models.

Introduction:-

The evolution of data models has been driven by increasing complexity of software applications and the need to align database with modern programming paradigms. The assignment explores the transition from the Relational Data Model(RDM) to the Object-Oriented Data Model (OODM) and the hybrid Object-Relational Data Model (ORDBMS)

1) Relational Data Model (RDM):-

Introduced 1970s (by E.F. Codd)

Idea:-

. Data is stored in tables (Relations).

Tables have rows (tuples) and columns (attributes)

Relationships are modeled using Foreign keys.

Data accessing using SQL.

Code snippets:-

(i)
```
create Table users (
      id serial Primary key,
      name Varchar (50),
      email Varchar (50)
   );
```

(ii)
```
Insert in to users
(name, email) values
('debottam kar',
  'debottam@gmail.com')
;
```

(iii) select * from users

→

Id	name	email
1	Debottam kar	debottam@gmail.com

Id, name and email are attributes of Relation user and <1, 'Debottam kar', 'debottam@gmail.com'> is the first tuple.

Advantages:-

(i) simple and robust

(ii) strong theoritical Foundation

(iii) strong and Mature technology with widespreaded use.

Disadvantages:-

(i) Poor suppor for complex data types (e.g., nested structures).

(ii) Does'nt directly mapped to object oriented code.

(iii) Requires additional (orm) layers to bridge the object-relational gap.

2) Object-Oriented Data Model (OODM)

Introduced: 1980s-1990s

Core Concept: Integrated database systems with object-oriented programming.

Code snippets:-

```
public class User{
        int id;
        string name;
        string email;
        Random Rand = new Random();
      public User(String name, string email){
            this.id = (Rand.nextInt(9999)+1000);
            this.name = name;
            this.email= email;
      }

User newUser = new User("Debottam Kar",
                         "debottam@gmail.com");
```

→
```
{ "id": 7683,
  "name": "Debottam Kar",
  "email": "debottam@gmail.com"
}
```

Key Features:-

(i) Data is stored as objects

(ii) Supports inheritance, encapsulation, and polymorphism.

objects can contain complex nested attoributes.

Advantages:-

(i) closer integration with object oriented languages(e.g, Java, c++);

(ii) can represent real-woorld entries more naturally.

Disadvantages:-

(i) Poor query language support.

(ii) weak adoption, hard to optimize.

(iii) object database like objectstore, versant didnot go mainstream.

3) object Relational Data Model(ORDM)

Gained popularity 1990s-2000s

Idea:- Combine relational strength with object-oriented features.

Extend SQL with

user-defined types (UDTs).

Nested-complex Types.

Inheritance.

Method on types.

Example:- PostgresQL supports arrays, JSON, custom data types.

Oracle and DB2 added object-Relational extensions.

code snippet:-

```
postgresQL custom data type
  create type address as (
        city TEXT,
        Country TEXT
     )
  creat Table Users(
        Id serial primary key,
        name TEXT,
        email TEXT,
        home_address address
     )
Insert into Users( name, email, home_address)
   values ('Debottam Kar', 'debottam@gmail.com',
            ROW('Kolkata', 'India'));
```

Advantages:-

(i) supports richer data structures with out aborting tables.

(ii) Levarages existing RDBMS infrastructures (Postgres, Oracle)

(iii) Ideal for applications needing both flexibility and performace.

Limitations:-

(i) More complex schema design.

(ii) Can be harder to optimize.

(iii) Still often needs an ORM for integration with object oriented code.

Summary:-

Feature	Relational	Object-oriented	Object-Relational
Data Format	Table	Objects	Table + Object Types
Query Language	SQL	Proprietary	Extended SQL
Using in Moder Apps	widely used	Rare	Increasing in use.
Tooling & echo system	Mature	niche	Evolving.

Relevance to Developer Today:-

Most modern developers works with relational databases. However tools like Prisma, drizel Type_ORM, help bridge the gap between objects in codeand tables in database acting as ORM. (Object-Relational Mappers).