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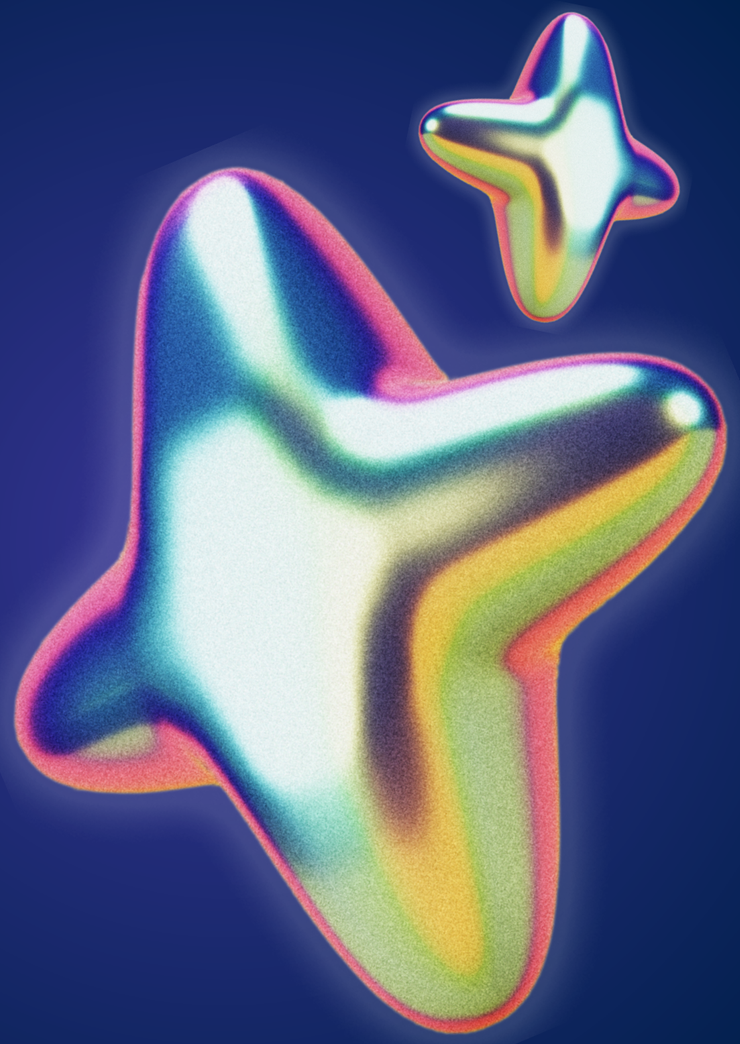
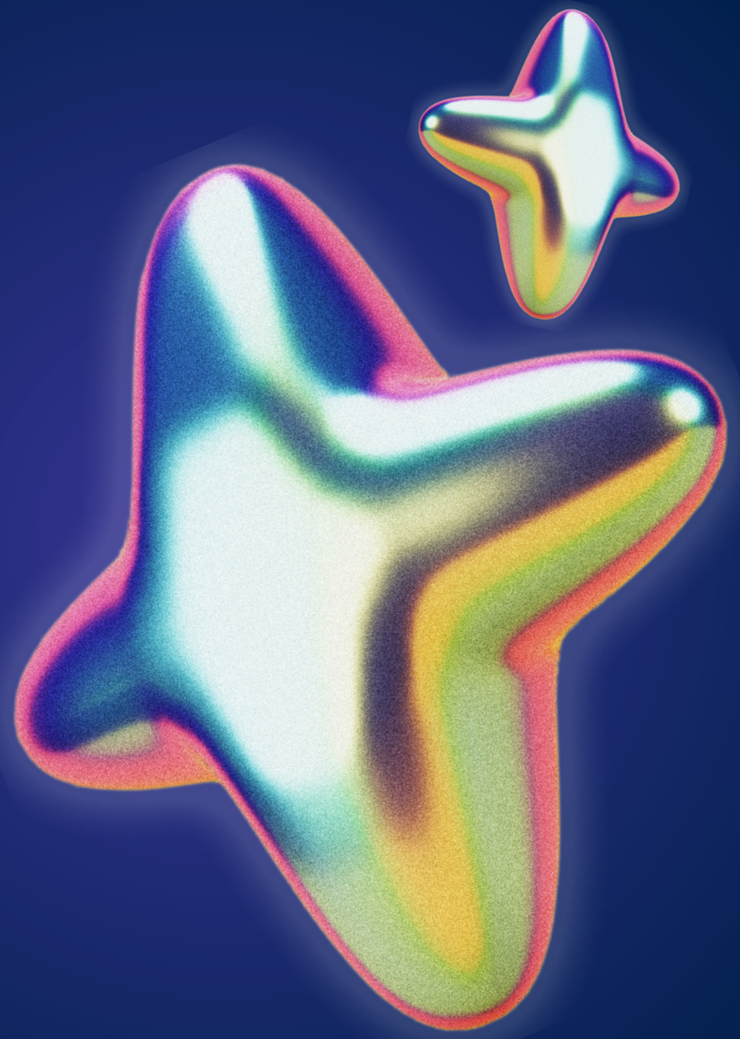


Database Models

A database model defines how data is structured, stored, and manipulated within a database. Common models include flat-file, hierarchical, network, relational, object-relational, and star-schema, each suited to different scenarios .



Create a presentation that:

- Discuss one database model:

Flat-file model

Hierarchical model

Network model

Relational model

Object-relational model

Star-schema model

- Describe tiered architecture to manage data more effectively

- Discuss relational database management systems

- Choose 2 RDBMS applications and compare them to each other

Flat-file model

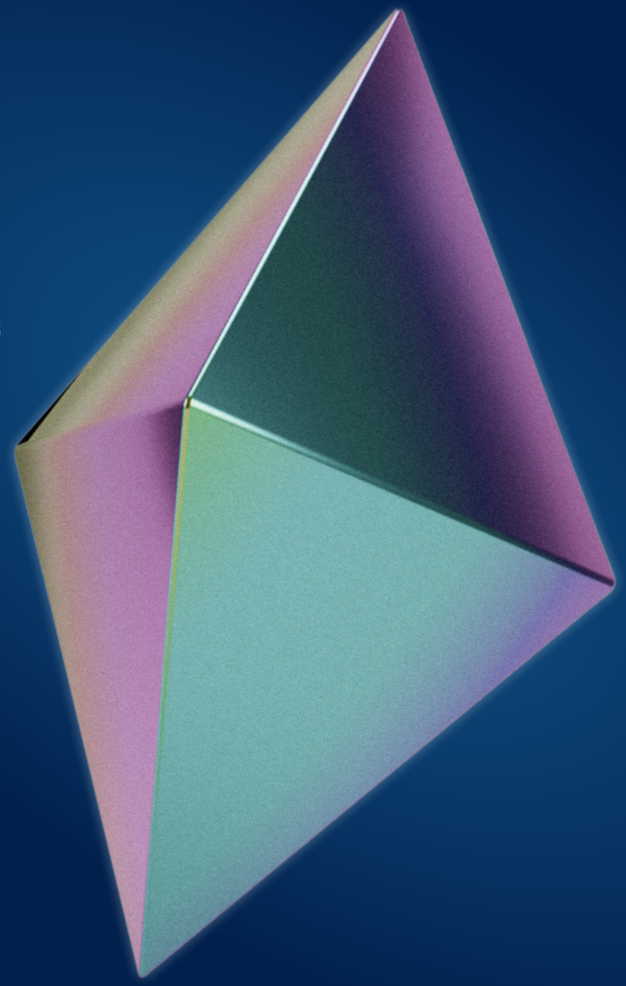
Stores data in a single two-dimensional array (rows and columns), where each row holds related elements and each column holds similar data types. It's simple but suffers from redundancy and limited querying capabilities .

Hierarchical model

Organizes data in a tree-like parent-child structure. Each parent can have multiple children but a child has only one parent. This enforces predefined paths for data access, enhancing performance but reducing flexibility .

Network model

Represents data using records and sets, allowing multiple parent-child relationships. Schemas and subschemas offer different logical views, reducing redundancy while supporting complex many-to-many links .



Relational model

Structures data into tables (relations) of rows (tuples) and columns (attributes). A central engine manages these independent tables, ensuring data integrity through keys and reducing redundancy.

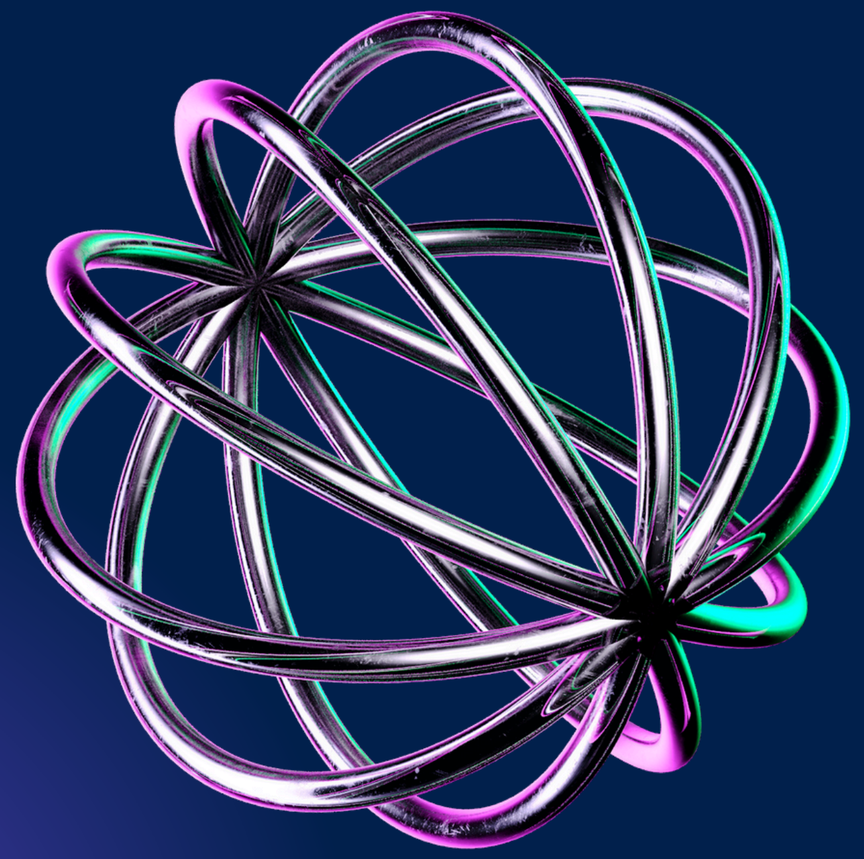
Object-relational model

Extends the relational model by supporting objects, classes, inheritance, and methods directly in the schema. It bridges relational databases with object-oriented programming needs.

Star-schema model

A denormalized structure used in data warehousing: one or more central fact tables surrounded by dimension tables. This simplifies queries and accelerates reporting.

Tiered Architecture



To improve scalability, maintainability, and security, database systems are often split into tiers or layers :

- Two-tier (Client-Server)

A client application communicates directly with a centralized database server over a network. Changes to server configuration can require client updates; typically used in smaller or intranet setups .

- Multi-tier (N-tier, typically Three-tier)
  - Presentation layer: User interface, handling input/output.
  - Application (logic) layer: Processes business rules, validations, calculations.
  - Data layer: Manages storage and retrieval from the database.
  - This separation promotes modularity, easier maintenance, and scalability in enterprise environments .

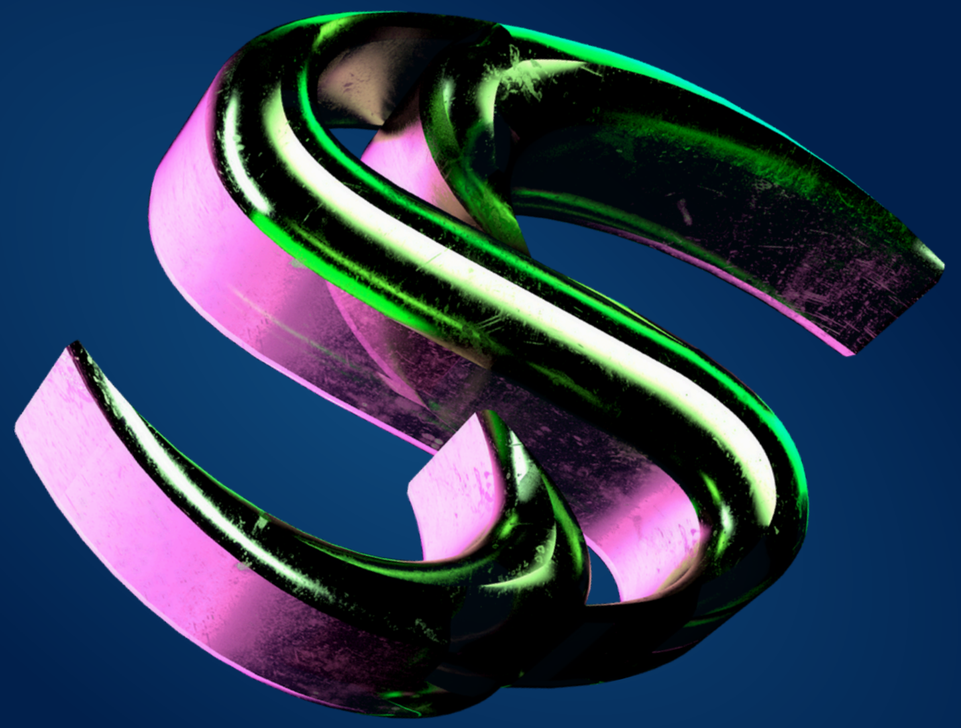
Relational Database Management Systems

Relational Database Management Systems (RDBMS)

An RDBMS is a DBMS that implements the relational model: data is stored in tables (relations), rows (tuples), and columns (attributes). A central database engine processes SQL queries, enforces integrity constraints, and maintains data independence and consistency .

Different RDBMS products cater to varied business and technical needs :

- Oracle (Oracle Corporation)
  - Object-oriented features, supports arrays, advanced partitioning, compression, and high-availability architectures.
- SQL Server (Microsoft)
  - Integrated reporting, analysis, and synchronization tools; strong Windows ecosystem support.
- MySQL (Oracle/Sun Microsystems)
  - Open-source, modifiable, widely used for web applications; balances performance and simplicity.
- Sybase (SAP/Sybase Inc.)
  - Enterprise-grade with strong support for large-scale data mobilization and integration.



Data Warehousing

A data warehouse is a specialized RDBMS designed for high-performance querying and analysis of historical data. It often incorporates ETL (Extract, Transform, Load) tools to consolidate data from transactional systems and other sources, enabling fast OLAP (Online Analytical Processing) operations.

OLTP vs. OLAP

OLTP (Online Transaction Processing): Complex normalized schemas, few indexes, optimized for fast transactional updates.
OLAP (Online Analytical Processing): Denormalized, multidimensional schemas (e.g., star), many indexes, optimized for rapid read and aggregation queries.