

Database Fundamentals

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Database adalah kumpulan data yang terorganisir dan dapat diakses secara elektronik.

Jenis-jenis Database:

1. Relational Database (SQL)

- Menggunakan tabel dengan rows dan columns
- ACID properties (Atomicity, Consistency, Isolation, Durability)
- Contoh: MySQL, PostgreSQL, SQLite, Oracle

2. NoSQL Database

- Document-based: MongoDB, CouchDB
- Key-value: Redis, DynamoDB
- Column-family: Cassandra, HBase
- Graph: Neo4j, Amazon Neptune

Database Operations (CRUD):

- Create: Menambahkan data baru
- Read: Membaca atau mengambil data
- Update: Mengubah data yang sudah ada
- Delete: Menghapus data

SQL (Structured Query Language):

- DDL (Data Definition Language): CREATE, ALTER, DROP
- DML (Data Manipulation Language): INSERT, UPDATE, DELETE
- DQL (Data Query Language): SELECT
- DCL (Data Control Language): GRANT, REVOKE

Basic SQL Commands:

```
CREATE TABLE users (  
id INT PRIMARY KEY,  
name VARCHAR(100),  
email VARCHAR(100) UNIQUE  
);
```

```
INSERT INTO users (id, name, email) VALUES (1, 'John', 'john@email.com');
```

```
SELECT * FROM users WHERE name = 'John';
```

```
UPDATE users SET email = 'newemail@email.com' WHERE id = 1;
```

```
DELETE FROM users WHERE id = 1;
```

Normalization:

- 1NF (First Normal Form): Eliminate duplicate columns
- 2NF (Second Normal Form): Meet 1NF + remove partial dependencies
- 3NF (Third Normal Form): Meet 2NF + remove transitive dependencies
- BCNF (Boyce-Codd Normal Form): Stricter version of 3NF

Database Design Principles:

1. Identify entities and relationships
2. Define primary and foreign keys
3. Normalize tables to reduce redundancy
4. Create indexes for better performance
5. Implement constraints for data integrity

Popular Database Management Systems:

- MySQL: Open-source relational database
- PostgreSQL: Advanced open-source database
- MongoDB: Document-oriented NoSQL database
- Redis: In-memory key-value store
- SQLite: Lightweight embedded database
- Oracle: Enterprise-grade database
- Microsoft SQL Server: Microsoft's database solution

Database Performance Optimization:

- Indexing strategies
- Query optimization
- Partitioning
- Caching
- Connection pooling
- Database normalization/denormalization