Data Independence

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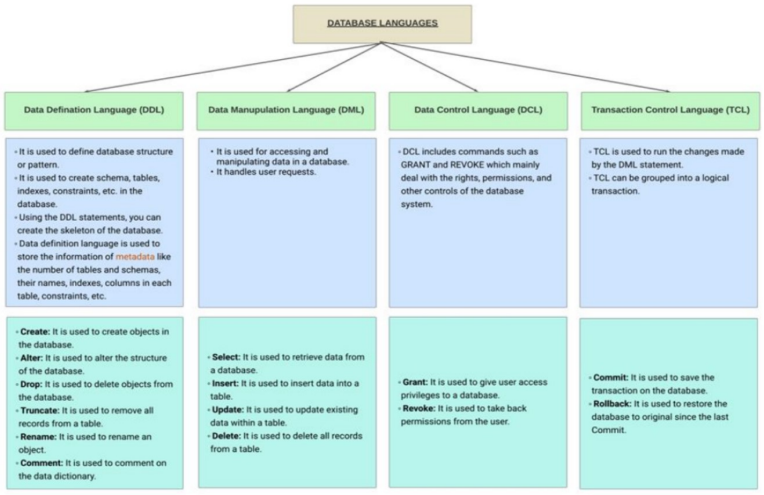

make the db change the db give Run the changes made permissions

DDL

- Output of DDL placed in data dictionary
- DDL compiler generates a set of table templates stored in data dictionary

- The data dictionary contains metadata (data about data)
  - Database schema
  - Integrity constraints
    - Primary key
  - Authorization
- Data dictionary can only be accessed and updated by db
- Db system consults data dictionary before reading or modifying data
- Db system checks consistency constraints before updating
- Db only implements constraints that can be verified with minimal overhead
- Integrity constraints:

  - Domain constraints
    - Declaring attribute to be of a particular domain i.e data/time, int, char
    - Most elementary integrity constraint

  - Referential integrity
    - A value that appears in one relation for a given set of attributes also appears in a certain set of attributes in another relation
    - Ex) dept name value in a course record must appear in the dept name attribute of some record of the department relation.
    - When violated, action that caused violation is rejected

  - Authorization
    - Makes sure no unauthorized changes are made
      o read authorization: which allows reading, but not modification, of data;
      o insert authorization: which allows insertion of new data, but not modification of existing data;
      o update authorization: which allows modification, but not deletion, of data;
      o delete authorization: which allows deletion of data.
    - We may assign the user all, none, or a combination of these types of authorization.

DML

- The types of access are:
  o Retrieval of information stored in the database.
  o Insertion of new information into the database.
  o Deletion of information from the database.
  o Modification of information stored in the database.

- Types of DML
  o Procedural DMLs - require a user to specify what data are needed and how to get those data.
  o Declarative DMLs/Non procedural DML - require a user to specify what data are needed without specifying how to get those data.

- Query: is a statement requesting the retrieval of information.
- Query language: Portion of DML that involves information retrieval
- Abstraction applies to DML as well
  - physical level, we must define algorithms that allow efficient access to data.
  - At higher levels of abstraction, we emphasize ease of use.

SQL Query Language

- Non procedural/ declarative
- A query takes as input several tables (possibly only one) and always returns a single table.
- SQL is NOT a Turing machine equivalent language
- To be able to compute complex functions SQL is usually embedded in some higher-level language
- Application programs generally access databases through one of Language extensions to allow embedded SQL
- Application program interface (e.g., ODBC/JDBC) which allows SQL queries to be sent to a database
- Provides rich DDL
  DDL

  ```
  CREATE TABLE department (

  dept name CHAR(20),
  building CHAR(15),

  budget NUMERIC(12,2) );
  ```

  DML

  ```
  SELECT instructor.name
  FROM instructor
  WHERE instructor.dept_name = 'History';
  ```

- SQL does not support actions such as input from users, output to displays, or communication over the network.
- Such computations and actions must be written in a host language, such as C/C++, Java, or Python, with embedded SQL queries that access the data in the database.
- Application programs are programs that are used to interact with the database in this fashion.
- The Open Database Connectivity (ODBC) standard defines application program interfaces for use with C and several other languages.
- The Java Database Connectivity (JDBC) standard defines a corresponding interface for the Java language.