Database Management System – 5 (Database Languages and Interfaces)

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Database Languages

- After design of database, first step is to specify conceptual and internal schemas for the database
- Any mappings between the two also to be specified
- Data Definition Language (DDL)
- Data Manipulation Language (DML)
- Storage Definition Language (SDL)
- View Definition Language (VDL)

Database Languages

- **Data Definition Language (DDL)**
  - Used by the DBA and database designers
  - To specify the conceptual schema of a database
  - DDL is also used to define internal and external schemas (views)
  - In some DBMSs, separate **storage definition language (SDL)** and **view definition language (VDL)**
    - used to define internal and external schemas

Database Languages

- **Data Manipulation Language (DML):**
  - Used to specify database retrievals and updates
  - DML commands (data sublanguage) can be *embedded* in a general-purpose programming language (host language), such as COBOL, C, C++, or Java
    - A library of functions can also be provided to access the DBMS from a programming language
  - Stand-alone DML commands can be applied directly (called a *query language*)

Types of DML

- **High Level or Non-procedural Language:**
  - For example, the SQL relational language
  - Are "set"-oriented and specify what data to retrieve rather than how to retrieve it
  - Called **declarative** languages
- **Low Level or Procedural Language:**
  - Retrieve data one record-at-a-time
  - Constructs such as looping are needed to retrieve multiple records, along with positioning pointers

DBMS Interfaces

- Stand-alone query language interfaces
  - Example: Entering SQL queries at the DBMS interactive SQL interface
- Programmer interfaces for embedding DML in programming languages
- User-friendly interfaces
  - Menu-based, forms-based, graphics-based, etc.

DBMS Interfaces

- Programmer interfaces for embedding DML in a programming languages
  - **Embedded Approach**: e.g embedded SQL (for C, C++, etc.), SQLJ (for Java)
  - **Procedure Call Approach**: e.g. JDBC for Java, ODBC for other programming languages
  - **Database Programming Language Approach**: e.g. ORACLE has PL/SQL, a programming language based on SQL; language incorporates SQL and its data types as integral components

User-Friendly DBMS Interfaces

- Menu-based, popular for browsing on the web
- Apps for Mobile Devices
- Forms-based, designed for naïve users
- Graphics-based
  - (Point and Click, Drag and Drop, etc.)
- Natural language: requests in written English
- Combinations of the above:
  - For example, both menus and forms used extensively in Web database interfaces

Other DBMS Interfaces

- Speech as Input and Output
- Web Browser as an interface
- Parametric interfaces, e.g., bank tellers using function keys
- Interfaces for the DBA:
  - Creating user accounts, granting authorizations
  - Setting system parameters
  - Changing schemas or access paths

Reference

- Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education 6th edition and 7th edition

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Thank you