1: Database Systems, Architecture, and Components



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information

data that has been processed (i.e., organized) into a meaningful context

phone number

metadata

data that describes the properties of raw data; metadata is the means by which data is transformed into information

10 digits, area code+local number

table 1.1 some metadata for a plant

| Record | Data Element | Data Type | Size | Source | Rule | Domain |
|--------|-----------------|------------|------|---------|---------|--------------------------|
| PLANT | PI_name | Alphabetic | 30 | Stored | Non-key | |
| PLANT | Pnumber | Numeric | 2 | Stored | Key | Integer values from 1-20 |
| PLANT | Budget | Numeric | 7 | Stored | Non-key | |
| PLANT | Building | Alphabetic | 20 | Stored | Non-key | |
| PLANT | No_of_employees | Numeric | 4 | Derived | Non-key | |

four actions to manage data

(C)REATE (R)EAD (U)PDATE (D)ELETE

an example - organizing your dvd collection

Untitled spreadsheet

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what are the different actions you can take?

My DVD Collection ☆ 🖿

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| 1 | dvdID | Title | Actor(s) | Extra Features | Languages | Subtitles | PGR | Length | Year | Producer | |
| 2 | 1 | "Database in 10 Acts" | Mike Parks | Grade | English, French | None | 21 | 10 weeks | 2013 | Me and myself | |
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two approaches for accessing data

sequential access vs. direct access

a DBMS facilitates access of data without burdening the user with these details





history of databases

Object-Oriented DBMS

Relational DBMS

Network DBMS

Hierarchical DBMS

File Systems

1950 1960 1970 1980 1990 2000



limitations of file processing systems

data integrity (is the data correct, complete, and consistent?) data standards (standards for naming data items and accessing/ updating/protecting data)

data flexibility/maintainability (not flexible to structural changes, dependent upon a programmer to write/modify code) limitations are due to:

× lack of data integration data is separated and isolated in a file-processing environment

× lack of program-data independence structure of each file is embedded in the application programs

we want:

no data in isolation application logic immune to changes in storage structure and access strategy independent user views of data

terms to remember

data integrity correct, consistent, complete,

and current

data redundancy redundancy is bad

ANSI/SPARC three-schema architecture:

conceptual schema

internal schema

external schema



conceptual schema

- core of the architecture
- global view of the structure of the entire database for users
- captures data specification (metadata)
- describes data items and relationships between data and the integrity constraints
- separates data from the program (or views from the physical storage structure)
- technology independent

internal schema

- physical structure of the stored data (how it is laid out on storage devices)
- describes mechanism used to implement access strategies (e.g. indexes, hashed addresses, etc.)
- concerned with efficiency of data storage and access mechanisms
- <u>technology dependent</u>

external schema

- different user views, each describing portions of the database
- views are generated exclusively by logical references
- technology independent

database system characteristics



database management system (DBMS)

collection of software that facilitates the process of defining, constructing, and manipulating a database for various applications

DBMS components



report generation tools

facilities for security, integrity, backup, recovery



types of database systems











commercial DBMS









data models



"universe of interest"

step 1. talk to users

gather the business rules

step 2. conceptual design: create a conceptual schema that captures the user-specified business rules



presentation-layer ER model ER diagram and semantic integrity constraints



design-specific ER model coarse and fine-level granularity



technology independent

step 3. logical design:

create a logical design and a logical schema



normalization



architecture hierarchical, network, or relational



technology independent → dependent

step 4. physical design:

specify internal storage structure and access strategies





technology dependent

the inside cover of your textbook is your new best friend.

use it as a guide for the rest of the semester.