CHAPTER 1 - Introduction
INITIAL TERMINOLOGY

§ **Data** - facts that are recorded and can be accessed
  • Data formats – text, numbers, figures, graphics, images, audio/video recordings and more
  • Data is recorded and kept because it is considered to be of use to an intended user

§ **Information** - refers to the data that is accessed by a user for some particular purpose
  • Typically, getting the needed information from a collection of data requires performing an activity, such as searching through, processing, or manipulating the data in some form or fashion
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§ Metadata - data that describes the structure and the properties of the data
  • Metadata is essential for the proper understanding and use of the data
INITIAL TERMINOLOGY

Data without metadata - example

<table>
<thead>
<tr>
<th>ID</th>
<th>Gender</th>
<th>Age</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>0001</td>
<td>B</td>
<td>2</td>
<td>11:01</td>
</tr>
<tr>
<td>0001</td>
<td>F</td>
<td>3</td>
<td>11:01</td>
</tr>
<tr>
<td>0002</td>
<td>S</td>
<td>2</td>
<td>11:02</td>
</tr>
<tr>
<td>0002</td>
<td>B</td>
<td>1</td>
<td>11:02</td>
</tr>
<tr>
<td>0003</td>
<td>F</td>
<td>2</td>
<td>11:03</td>
</tr>
</tbody>
</table>

... ... ... ...
INITIAL TERMINOLOGY

Data with metadata - example

<table>
<thead>
<tr>
<th>TransactionId</th>
<th>Product</th>
<th>ItemsSold</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>0001</td>
<td>B</td>
<td>2</td>
<td>11:01</td>
</tr>
<tr>
<td>0001</td>
<td>F</td>
<td>3</td>
<td>11:01</td>
</tr>
<tr>
<td>0002</td>
<td>S</td>
<td>2</td>
<td>11:02</td>
</tr>
<tr>
<td>0002</td>
<td>B</td>
<td>1</td>
<td>11:02</td>
</tr>
<tr>
<td>0003</td>
<td>F</td>
<td>2</td>
<td>11:03</td>
</tr>
</tbody>
</table>

**METADATA**

Burger Prince Store 101, Sales Data for Sept 1, 2013
(Product Codes: B – Burger, F – Fries, S – Soda)
INITIAL TERMINOLOGY

§ **Database** - structured collection of related data stored on a computer medium
  • Organizes the data in a way that facilitates efficient access to the information captured in the data

§ **Database metadata** – represents the structure of the database
  • Database content that is not the data itself (data about the data)
  • Contains:
    o Names of data structures
    o Data types
    o Data descriptions
    o Other information describing the characteristics of the data
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§ Database management system (DBMS) - software used for:
  • Creation of databases
  • Insertion, storage, retrieval, update, and deletion of the data in the database
  • Maintenance of databases

§ Database system - computer-based system whose purpose is to enable an efficient interaction between the users and the information captured in a database
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Typical database system architecture
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§ Front-end applications - provide a mechanism for easy interaction between the users and the DBMS

§ End-users (business-users) - users using a database system to support their tasks and processes

§ Indirect interaction - end-user communicating with the database through front-end applications

§ Direct interaction - end-user communicating with the database directly through DBMS
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Typical database system architecture
STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

Database Requirements
- Requirements Collection
- Requirements Definition
- Requirements Visualization
  (Conceptual Modeling)

Database Modeling
(Logical Modeling)

Database Implementation

Database Deployment

Database Use
(direct and/or indirect use)

Developing Front-End Applications
(for indirect access)

Database Administration and Maintenance
§ Requirements collection, definition, and visualization - results in the requirements specifying which data the future database system will hold and in what fashion, and what the capabilities and functionalities of the database system will be

• The collected requirements should be clearly defined and stated in a written document, and then visualized
§ Requirements collection, definition, and visualization

- **Conceptual database model** – a visualization of requirements by using a conceptual data modeling technique (such as entity-relationship [ER] modeling)
STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

Iterative nature of the database requirements collection, definition, and visualization process
STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

§ Database modeling (logical database modeling) - creation of the database model that is implementable by the DBMS software

- Logical database modeling follows conceptual database modeling
STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

§ Database implementation - using a DBMS to implement the database model as an actual database

- Most modern databases are implemented using a relational DBMS (RDBMS) software
STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

§ Developing front-end applications - designing and creating applications for indirect use by the end-users

• Front-end applications are based on the database model and the requirements specifying the front-end functionalities
• Front-end applications contain interfaces (such as forms and reports) accessible via a navigation mechanism (such as a menu)
STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

§ Database deployment - releasing the database system for use by the end users
STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

§ Database use - the insertion, modification, deletion and retrieval of the data in the database system
STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

§ Database administration and maintenance - performing activities that support the database end user, including dealing with technical issues, such as:

- Providing security for the information contained in the database
- Ensuring sufficient hard-drive space for the database content
- Implementing the backup and recovery procedures
THE NEXT VERSION OF THE DATABASE

§ The new version of the database follows the same development steps as the initial version
THE NEXT VERSION OF THE DATABASE

- Database Requirements
  - Requirements Collection
  - Requirements Definition
  - Requirements Visualization (Conceptual Modeling)

- Database Modeling (Logical Modeling)

- Database Implementation

- Database Deployment
  - Database Use (direct and/or indirect use)

- Developing Front-End Applications (for indirect access)

- Database Administration and Maintenance
DATABASE SCOPE

§ Databases can vary in their scope from small single-user (personal) databases to large enterprise databases that can be used by thousands of end-users

§ Regardless of their scope, all databases go through the same fundamental development steps (requirements, modeling, implementation, deployment, use, etc.)
PEOPLE INVOLVED WITH DATABASE SYSTEMS

§ Database analysts, designers, and developers

- **Database analysts** - involved in the requirements collection, definition, and visualization stage
- **Database designers** (a.k.a. database modelers or architects) - involved in the database modeling stage
- **Database developers** – in charge of implementing the database model as a functioning database using the DBMS software
§ Front-end applications analysts and developers

- Front-end application analysts - in charge of collecting and defining requirements for front-end applications
- Front-end applications developers - in charge of creating the front-end applications
PEOPLE INVOLVED WITH DATABASE SYSTEMS

§ Database administrators (DBAs) - perform the tasks related to the maintenance and administration of a database system
PEOPLE INVOLVED WITH DATABASE SYSTEMS

§ **Database end users** - use a database system to support their work- or life-related tasks and processes

- Users differ in:
  - Level of technical sophistication
  - Amount of data that they need
  - Frequency with which they access the database system
OPERATIONAL VERSUS ANALYTICAL DATABASES

§ Operational information (transactional information) - the information collected and used in support of day to day operational needs in businesses and other organizations

§ Operational database - collects and presents operational information in support of daily operational procedures and processes

§ Analytical information - the information collected and used in support of analytical tasks
  • Analytical information is based on operational (transactional) information

§ Analytical database - collects and presents analytical information in support of analytical tasks
BOOK TOPICS OVERVIEW

§ Issues related to the development and use of operational databases are covered in Chapters 2–6
§ Issues related to the development and use of analytical databases are covered in Chapters 7–9
§ Chapter 10 provides an overview of some of the basic functionalities of relational DBMS packages and illustrate how those functionalities are used for administration and maintenance of both operational and analytical databases