



CPL230-PENGEMBANGAN PERANGKAT LUNAK (PERTEMUAN-12)

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Prodi Teknik Informatika Fakultas Ilmu Komputer



Chapter 7

Managing Data Resources



Management Information Systems

Chapter 7 Managing Data Resources

OBJECTIVES

- **Describe basic file organization concepts and the problems of managing data resources in a traditional file environment**
- **Describe how a database management system organizes information and compare the principal database models**
- **Apply important database design principles**



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OBJECTIVES (Continued)

- **Evaluate new database trends**
- **Identify the challenges posed by data resource management and management solutions**



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Virgin Mobile Australia Case

- **Challenge:** Fragmented and isolated corporate systems creating a single integrated view of customers and operations
- **Solution:** single integrated corporate data warehouse, using a single data model.
- Oracle 9i database provides near real-time access to customer activity, customer profitability, and customer reactions
- Illustrates the importance of managing data resources for achieving profitability



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ORGANIZING DATA IN A TRADITIONAL FILE ENVIRONMENT

File Organization Terms and Concepts

- **Bit:** Smallest unit of data; binary digit (0,1)
- **Byte:** Group of bits that represents a single character
- **Field:** Group of words or a complete number
- **Record:** Group of related fields
- **File:** Group of records of same type



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ORGANIZING DATA IN A TRADITIONAL FILE ENVIRONMENT

File Organization Terms and Concepts (Continued)

- **Database:** Group of related files
- **Entity:** Person, place, thing, event about which information is maintained
- **Attribute:** Description of a particular entity
- **Key field:** Identifier field used to retrieve, update, sort a record



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ORGANIZING DATA IN A TRADITIONAL FILE ENVIRONMENT

The Data Hierarchy

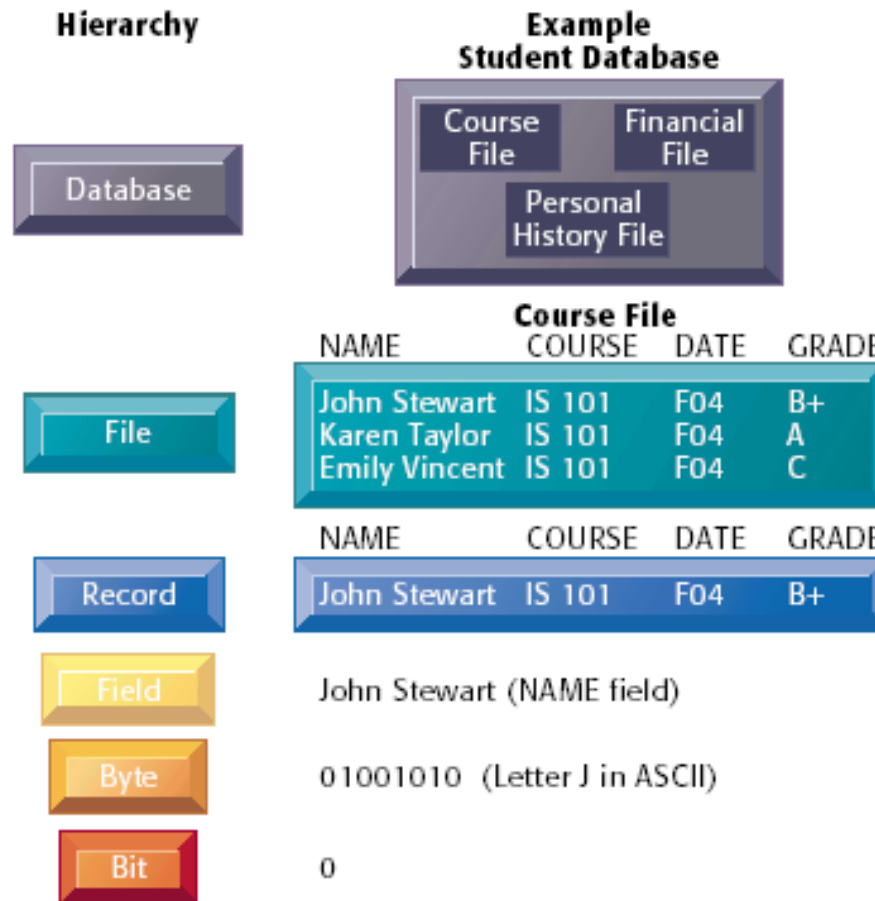


Figure 7-1

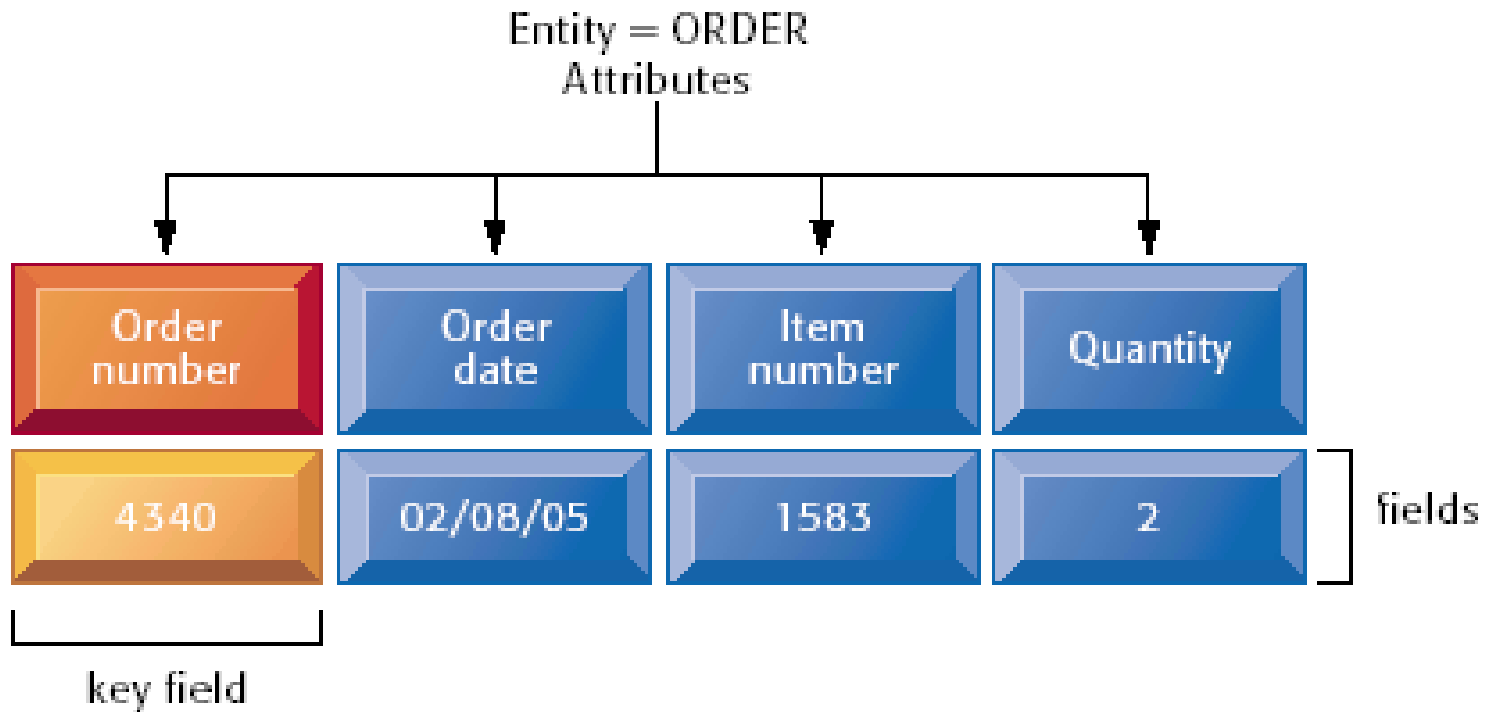


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ORGANIZING DATA IN A TRADITIONAL FILE ENVIRONMENT

Entities and Attributes





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ORGANIZING DATA IN A TRADITIONAL FILE ENVIRONMENT

Problems with the Traditional File Environment

Data Redundancy and Inconsistency:

- **Data redundancy:** The presence of duplicate data in multiple data files so that the same data are stored in more than one place or location
- **Data inconsistency:** The same attribute may have different values.



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ORGANIZING DATA IN A TRADITIONAL FILE ENVIRONMENT

Problems with the Traditional File Environment (Continued)

Program-data dependence:

- The coupling of data stored in files and the specific programs required to update and maintain those files such that changes in programs require changes to the data

Lack of flexibility:

- A traditional file system can deliver routine scheduled reports after extensive programming efforts, but it cannot deliver ad-hoc reports or respond to unanticipated information requirements in a timely fashion.



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ORGANIZING DATA IN A TRADITIONAL FILE ENVIRONMENT

Problems with the Traditional File Environment (Continued)

Poor security:

- Because there is little control or management of data, management will have no knowledge of who is accessing or even making changes to the organization's data.

Lack of data sharing and availability:

- Information cannot flow freely across different functional areas or different parts of the organization. Users find different values of the same piece of information in two different systems, and hence they may not use these systems because they cannot trust the accuracy of the data.

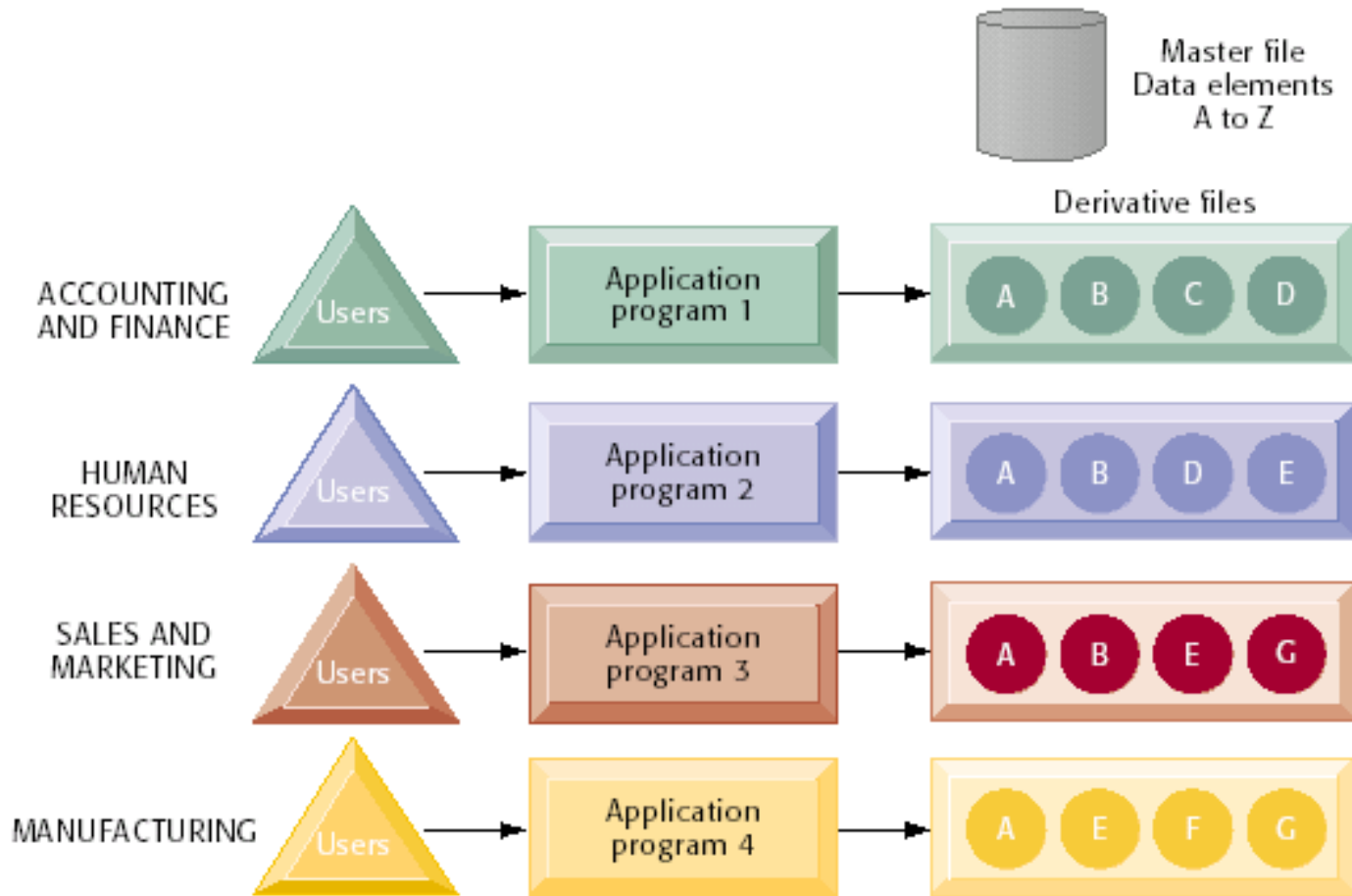


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ORGANIZING DATA IN A TRADITIONAL FILE ENVIRONMENT

Traditional File Processing





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THE DATABASE APPROACH TO DATA MANAGEMENT

Database Management System (DBMS)

- **Software for creating and maintaining databases**
- **Permits firms to rationally manage data for the entire firm**
- **Acts as interface between application programs and physical data files**
- **Separates logical and design views of data**
- **Solves many problems of the traditional data file approach**

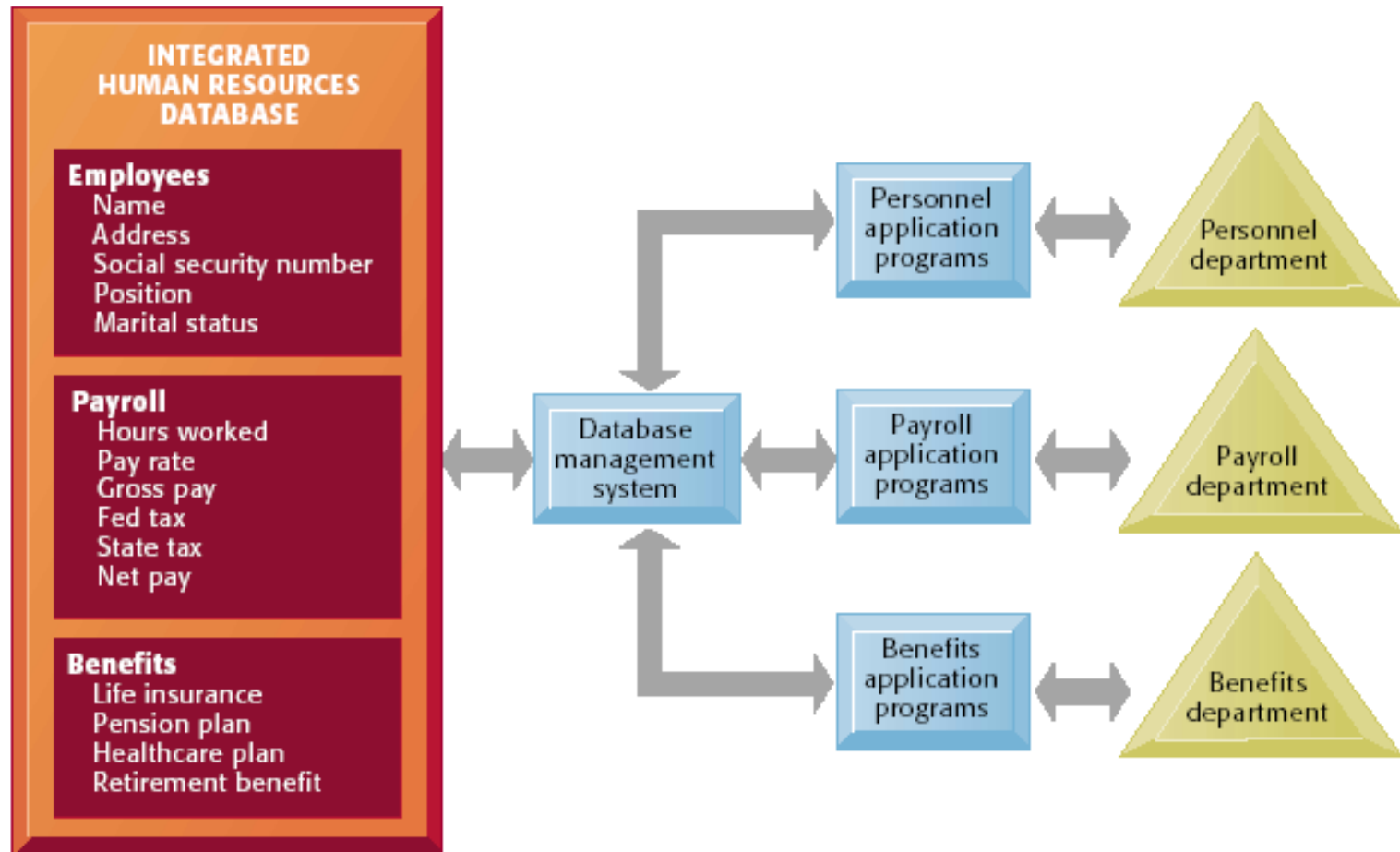


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THE DATABASE APPROACH TO DATA MANAGEMENT

The Contemporary Database Environment





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Components of DBMS:

- **Data definition language:** Specifies content and structure of database and defines each data element
- **Data manipulation language:** Used to process data in a database
- **Data dictionary:** Stores definitions of data elements and data characteristics



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THE DATABASE APPROACH TO DATA MANAGEMENT

Sample Data Dictionary Report

NAME: AMT-PAY-BASE
FOCUS NAME: BASEPAY
PC NAME: SALARY

DESCRIPTION: EMPLOYEE'S ANNUAL SALARY

SIZE: 9 BYTES
TYPE: N (NUMERIC)
DATE CHANGED: 01/01/04
OWNERSHIP: COMPENSATION
UPDATE SECURITY: SITE PERSONNEL
ACCESS SECURITY: MANAGER, COMPENSATION PLANNING AND RESEARCH
MANAGER, JOB EVALUATION SYSTEMS
MANAGER, HUMAN RESOURCES PLANNING
MANAGER, SITE EQUAL OPPORTUNITY AFFAIRS
MANAGER, SITE BENEFITS
MANAGER, CLAIMS PAYING SYSTEMS
MANAGER, QUALIFIED PLANS
MANAGER, SITE EMPLOYMENT/EEO

BUSINESS FUNCTIONS USED BY: COMPENSATION
HR PLANNING
EMPLOYMENT
INSURANCE
PENSION
401K

PROGRAMS USING: PI01000
PI02000
PI03000
PI04000
PI05000

REPORTS USING: REPORT 124 (SALARY INCREASE TRACKING REPORT)
REPORT 448 (GROUP INSURANCE AUDIT REPORT)
REPORT 452 (SALARY REVIEW LISTING)
PENSION REFERENCE LISTING



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THE DATABASE APPROACH TO DATA MANAGEMENT

Types of Databases:

- **Relational DBMS**
- **Hierarchical and network DBMS**
- **Object-oriented databases**



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Relational DBMS:

- **Represents data as two-dimensional tables called relations**
- **Relates data across tables based on common data element**
- **Examples: DB2, Oracle, MS SQL Server**

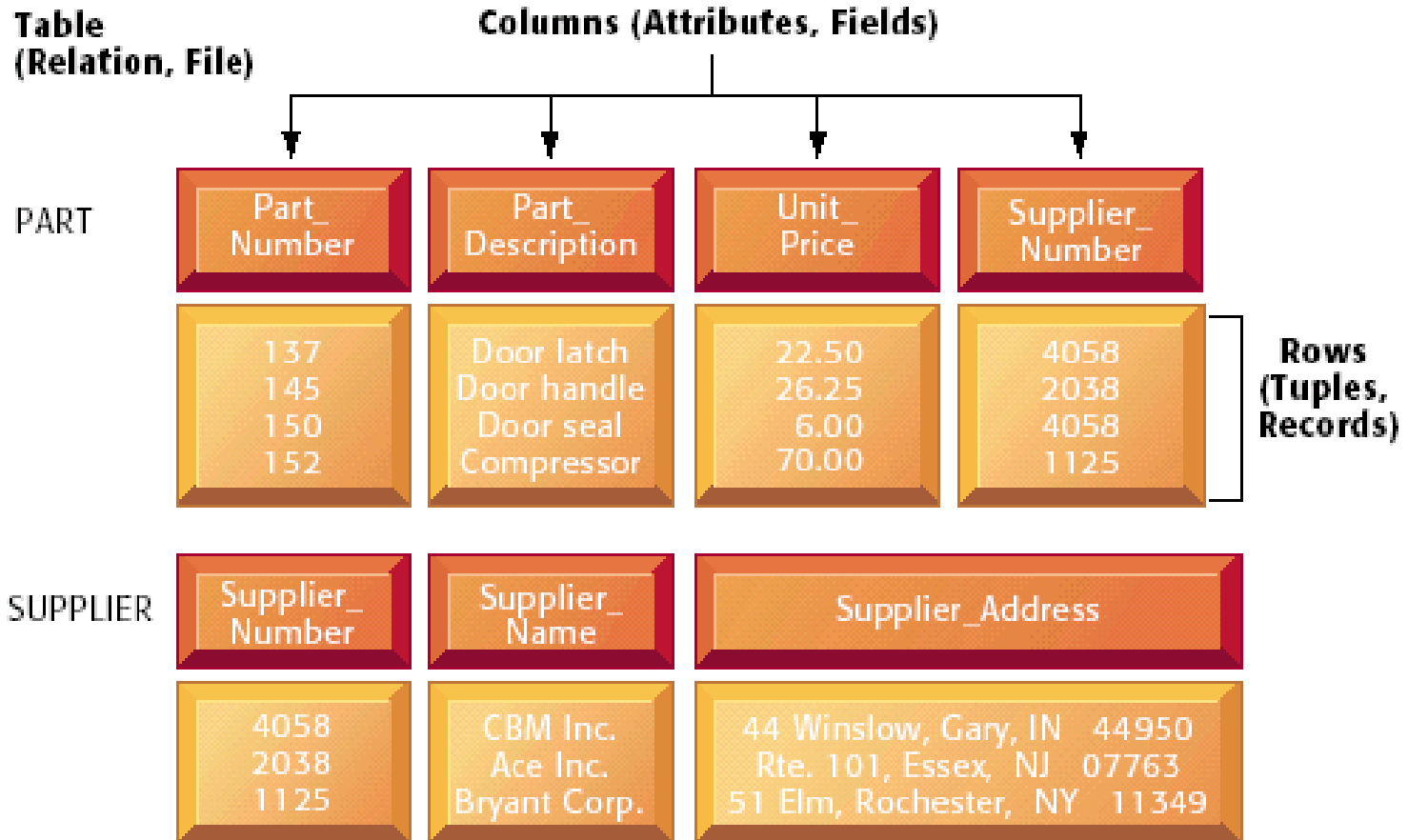


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The Relational Data Model





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Three Basic Operations in a Relational Database:

- **Select:** Creates subset of rows that meet specific criteria
- **Join:** Combines relational tables to provide users with information
- **Project:** Enables users to create new tables containing only relevant information

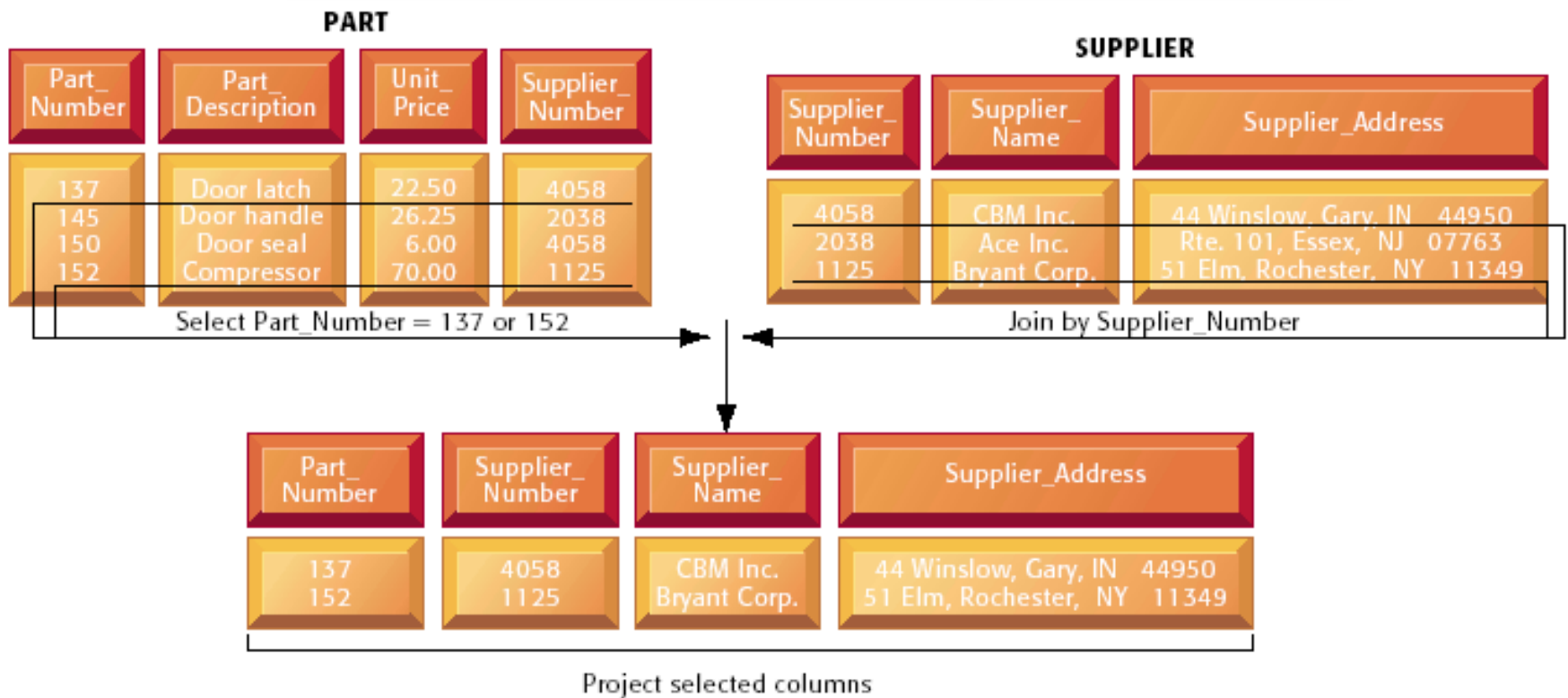


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The Three Basic Operations of a Relational DBMS





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Hierarchical and Network DBMS

Hierarchical DBMS:

- Organizes data in a tree-like structure
- Supports one-to-many parent-child relationships
- Prevalent in large legacy systems

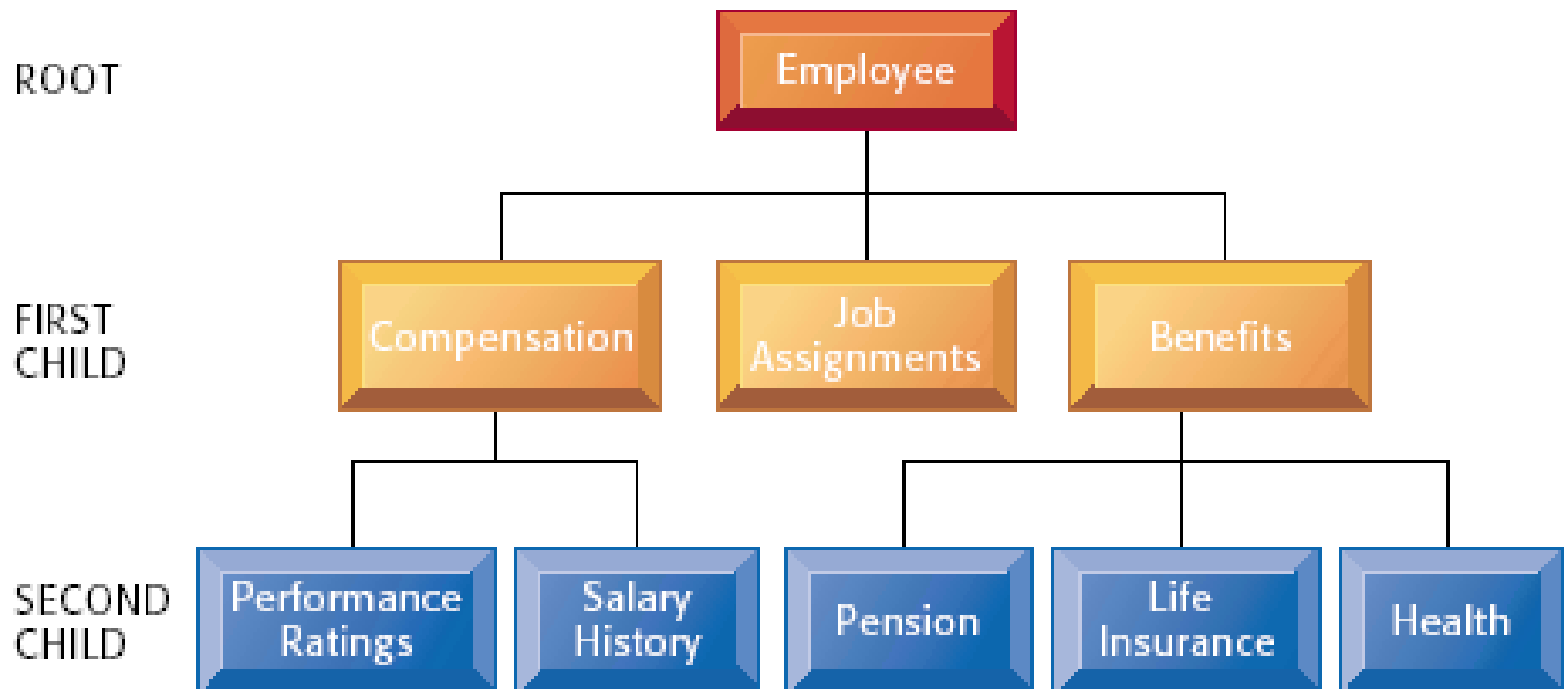


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THE DATABASE APPROACH TO DATA MANAGEMENT

A Hierarchical Database for a Human Resources System





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Hierarchical and Network DBMS

Network DBMS:

- **Depicts data logically as many-to-many relationships**

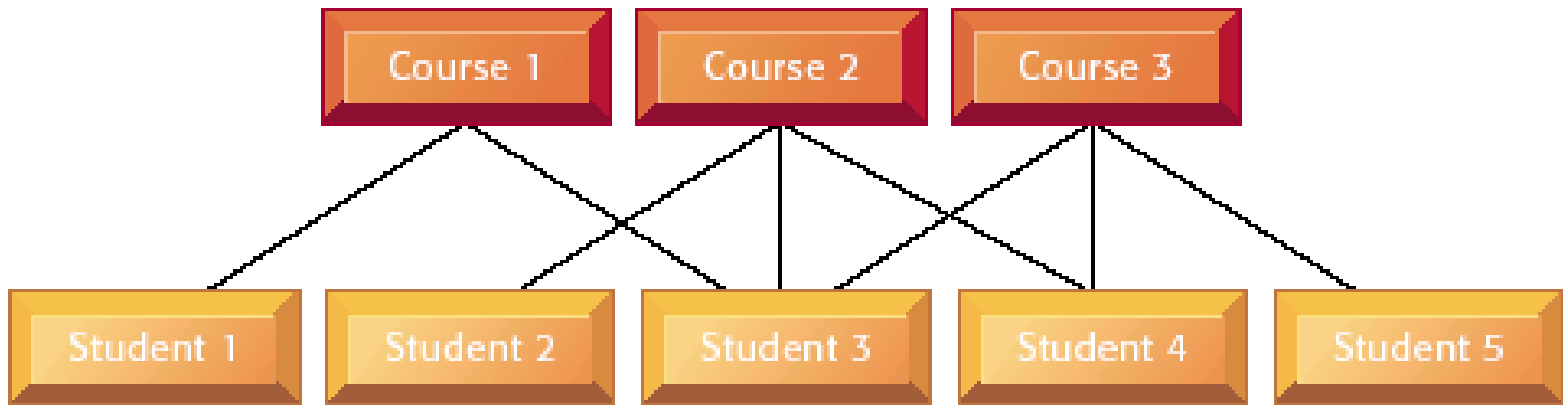


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THE DATABASE APPROACH TO DATA MANAGEMENT

The Network Data Model





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Hierarchical and Network DBMS

Disadvantages:

- **Outdated**
- **Less flexible compared to RDBMS**
- **Lack support for ad-hoc and English language-like queries**



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Object-Oriented Databases:

- **Object-oriented DBMS:** Stores data and procedures as objects that can be retrieved and shared automatically
- **Object-relational DBMS:** Provides capabilities of both object-oriented and relational DBMS



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CREATING A DATABASE ENVIRONMENT

Designing Databases:

- **Conceptual design:** Abstract model of database from a business perspective
- **Physical design:** Detailed description of business information needs



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CREATING A DATABASE ENVIRONMENT

Designing Databases: (Continued)

- **Entity-relationship diagram:** Methodology for documenting databases illustrating relationships between database entities
- **Normalization:** Process of creating small stable data structures from complex groups of data

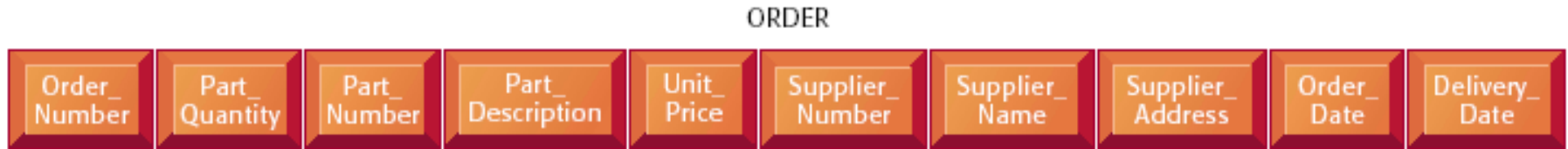


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CREATING A DATABASE ENVIRONMENT

An Unnormalized Relation for ORDER



An unnormalized relation contains repeating groups. For example, there can be many parts and suppliers for each order. There is only a one-to-one correspondence between Order_Number, Order_Date, and Delivery_Date.

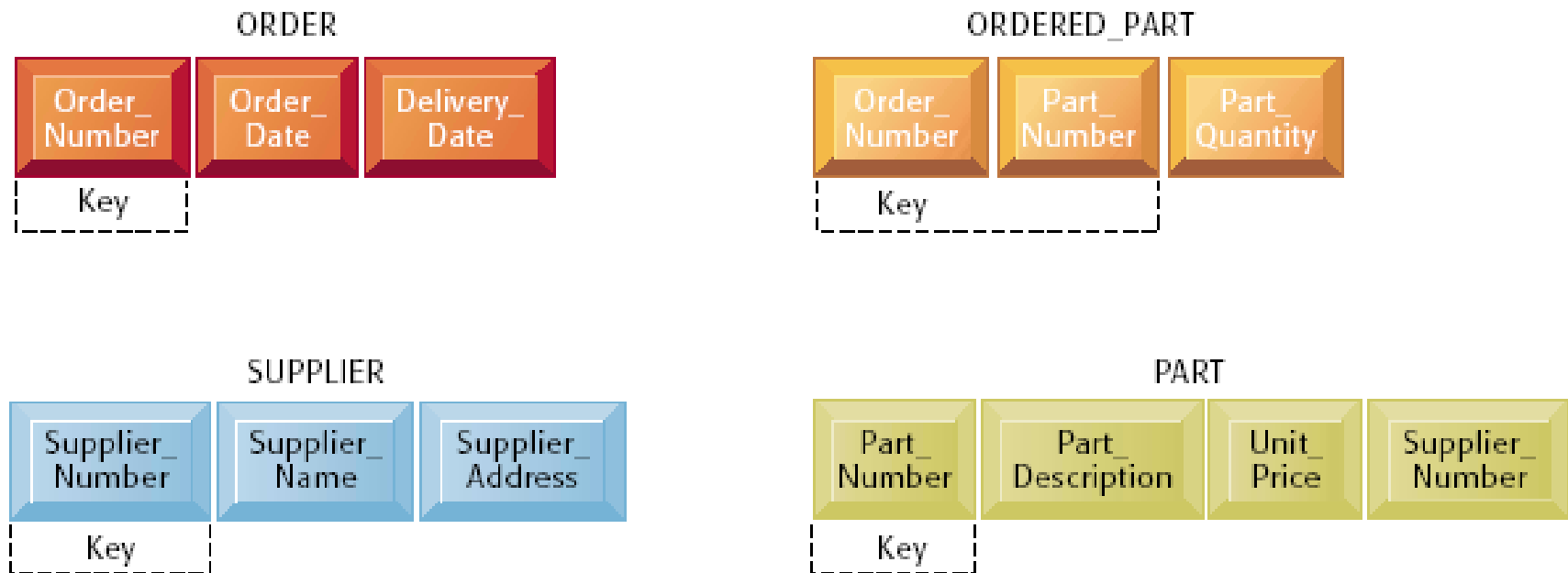


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CREATING A DATABASE ENVIRONMENT

Normalized Tables Created from ORDER



After normalization, the original relation ORDER has been broken down into four smaller relations. The relation ORDER is left with only three attributes and the relation ORDERED_PART has a combined, or concatenated, key consisting of Order_Number and Part_Number.

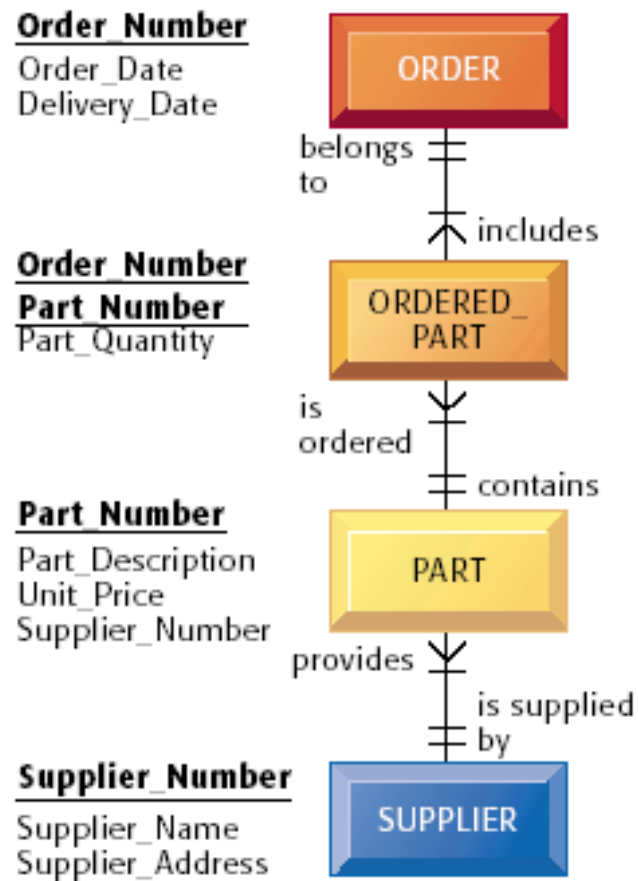


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CREATING A DATABASE ENVIRONMENT

An Entity-Relationship Diagram





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Distributing Databases

Centralized database:

- **Used by single central processor or multiple processors in client/server network**
- **There are advantages and disadvantages to having all corporate data in one location.**
- **Security is higher in central environments, risks lower.**
- **If data demands are highly decentralized, then a decentralized design is less costly, and more flexible.**



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CREATING A DATABASE ENVIRONMENT

Distributed database:

- Databases can be decentralized either by partitioning or by replicating
- **Partitioned database:** Database is divided into segments or regions. For example, a customer database can be divided into Eastern customers and Western customers, and two separate databases maintained in the two regions.



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CREATING A DATABASE ENVIRONMENT

- **Duplicated database:** The database is completely duplicated at two or more locations. The separate databases are synchronized in off hours on a batch basis.
- Regardless of which method is chosen, data administrators and business managers need to understand how the data in different databases will be coordinated and how business processes might be effected by the decentralization.

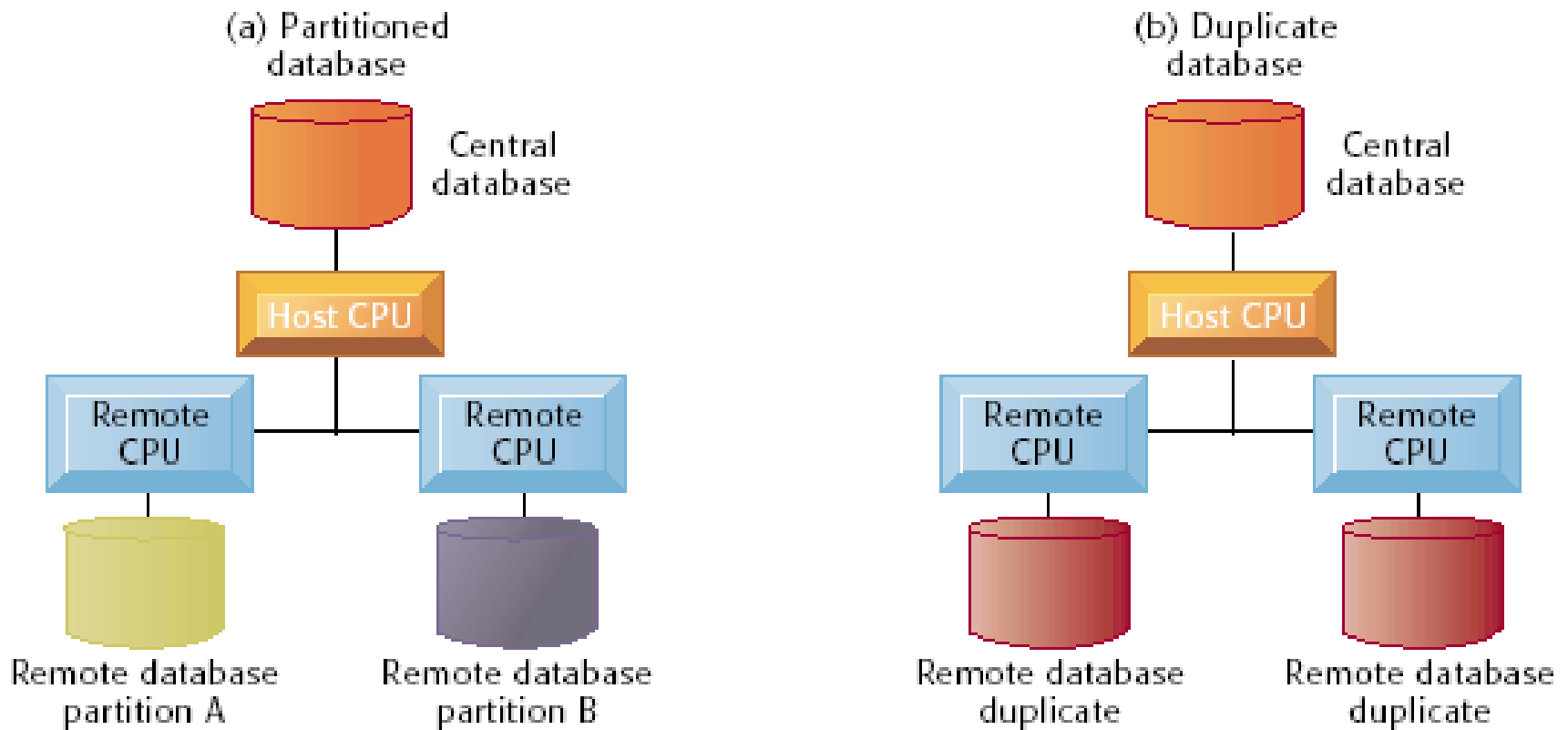


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CREATING A DATABASE ENVIRONMENT

Distributed Databases





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Ensuring Data Quality:

- **Corporate and government databases have unexpectedly poor levels of data quality.**
- **National consumer credit reporting databases have error rates of 20-35%.**
- **32% of the records in the FBI's Computerized Criminal History file are inaccurate, incomplete, or ambiguous.**
- **Gartner Group estimates that consumer data in corporate databases degrades at the rate of 2% a month.**



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CREATING A DATABASE ENVIRONMENT

Ensuring Data Quality: (Continued)

- The quality of decision making in a firm is directly related to the quality of data in its databases.
- **Data Quality Audit:** Structured survey of the accuracy and level of completeness of the data in an information system
- **Data Cleansing:** Consists of activities for detecting and correcting data in a database or file that are incorrect, incomplete, improperly formatted, or redundant



Multidimensional Data Analysis

Online Analytical Processing (OLAP):

- **Multidimensional data analysis**
- **Supports manipulation and analysis of large volumes of data from multiple dimensions/perspectives**

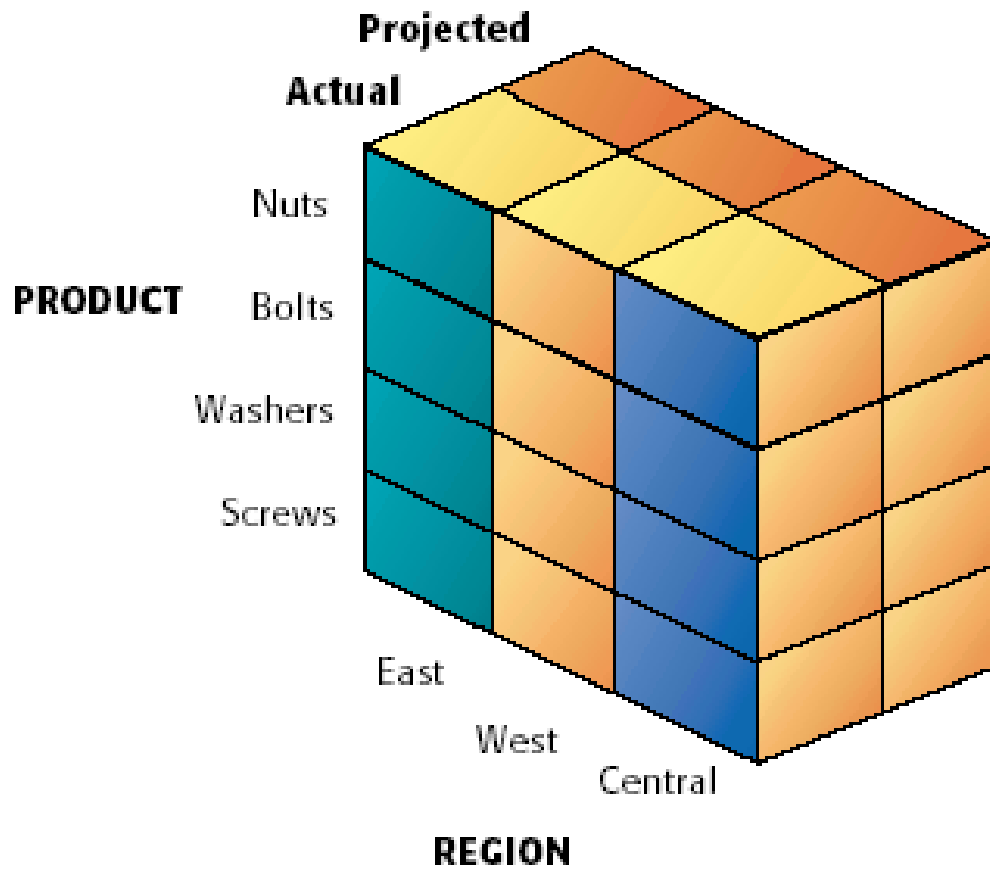


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DATABASE TRENDS

Multidimensional Data Model





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DATABASE TRENDS

Data Warehousing and Data Mining

Data warehouse:

- **Supports reporting and query tools**
- **Stores current and historical data**
- **Consolidates data for management analysis and decision making**

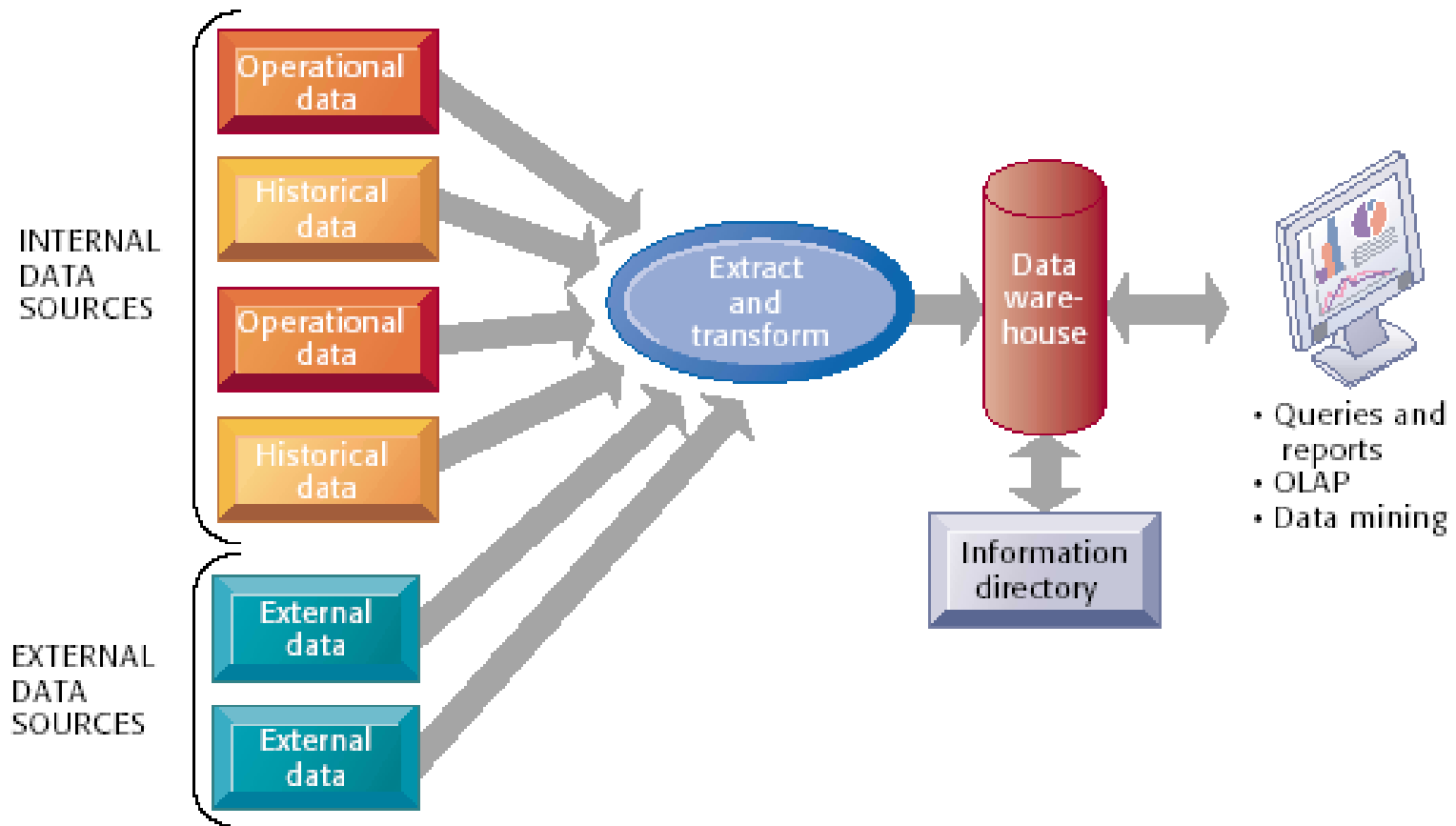


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DATABASE TRENDS

Components of a Data Warehouse





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DATABASE TRENDS

Data mart:

- **Subset of data warehouse**
- **Contains summarized or highly focused portion of data for a specified function or group of users**

Data mining:

- **Tools for analyzing large pools of data**
- **Find hidden patterns and infer rules to predict trends**



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DATABASE TRENDS

Benefits of Data Warehouses:

- **Improved and easy accessibility to information**
- **Ability to model and remodel the data**



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DATABASE TRENDS

Databases and the Web

The Web and Hypermedia database:

- Organizes data as network of nodes
- Links nodes in pattern specified by user
- Supports text, graphic, sound, video, and executable programs

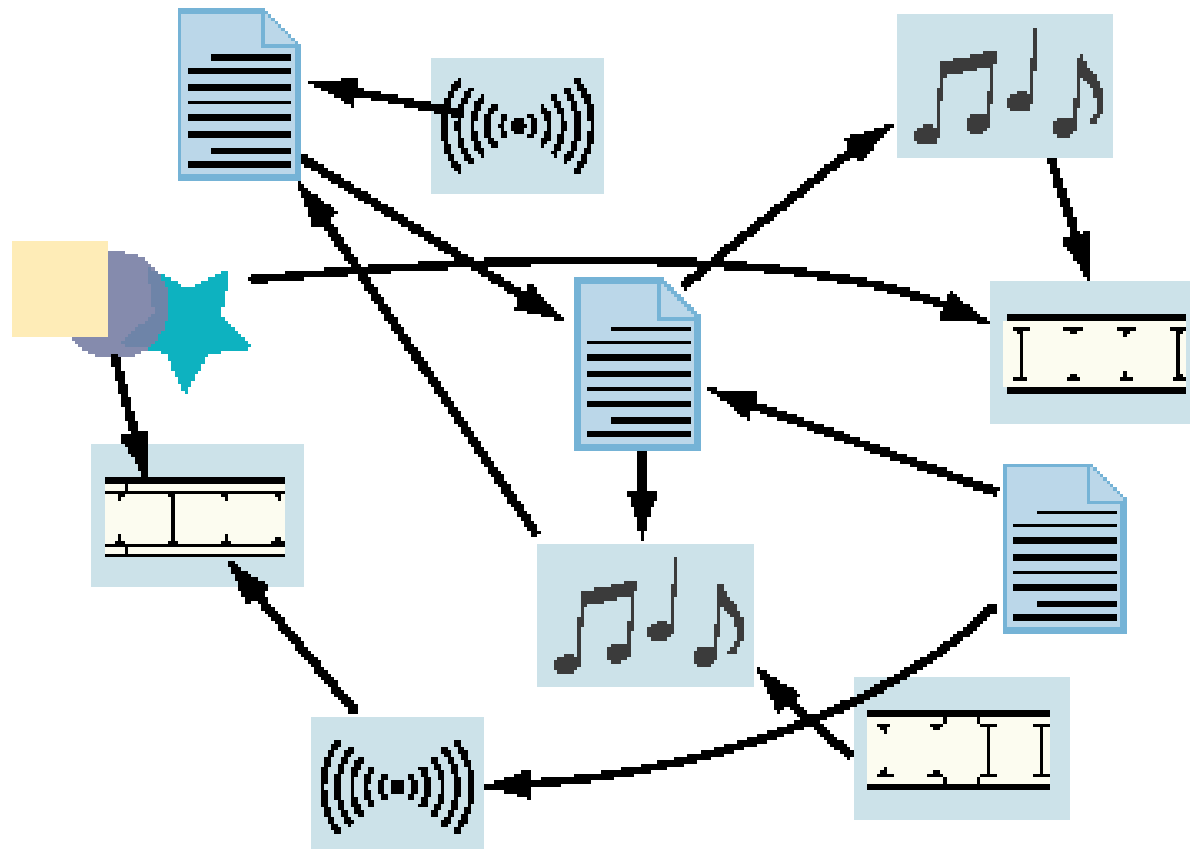


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DATABASE TRENDS

A Hypermedia Database





DATABASE TRENDS

Databases and the Web

Database server:

- **Computer in a client/server environment runs a DBMS to process SQL statements and perform database management tasks.**

Application server:

- **Software handling all application operations**

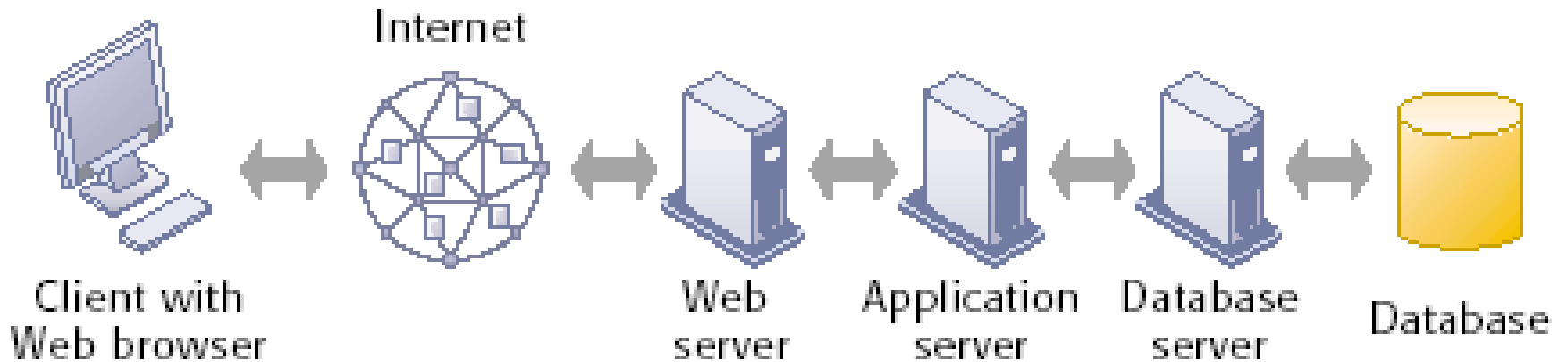


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DATABASE TRENDS

Linking Internal Databases to the Web





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MANAGEMENT OPPORTUNITIES, CHALLENGES, AND SOLUTIONS

Management Opportunities:

Business firms have exceptional opportunities to exploit modern relational database technologies to improve decision making, and to increase the efficiency of their business processes.



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MANAGEMENT OPPORTUNITIES, CHALLENGES, AND SOLUTIONS

Management Challenges:

- **Organizational obstacles to a database environment**
Need for cooperation in developing corporate-wide data administration

- **Cost/benefit considerations**
Bringing about significant change in the database environment of a firm can be very expensive and time consuming.



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MANAGEMENT OPPORTUNITIES, CHALLENGES, AND SOLUTIONS

Solution Guidelines:

The critical elements for creating a database environment are:

- **Data administration**
- **Data-planning and modeling methodology**
- **Database technology and management**
- **Users**



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MANAGEMENT OPPORTUNITIES, CHALLENGES, AND SOLUTIONS

Key Organizational Elements in the Database Environment

