Chapter 1: The Database Environment

Modern Database Management

6th Edition

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Definitions

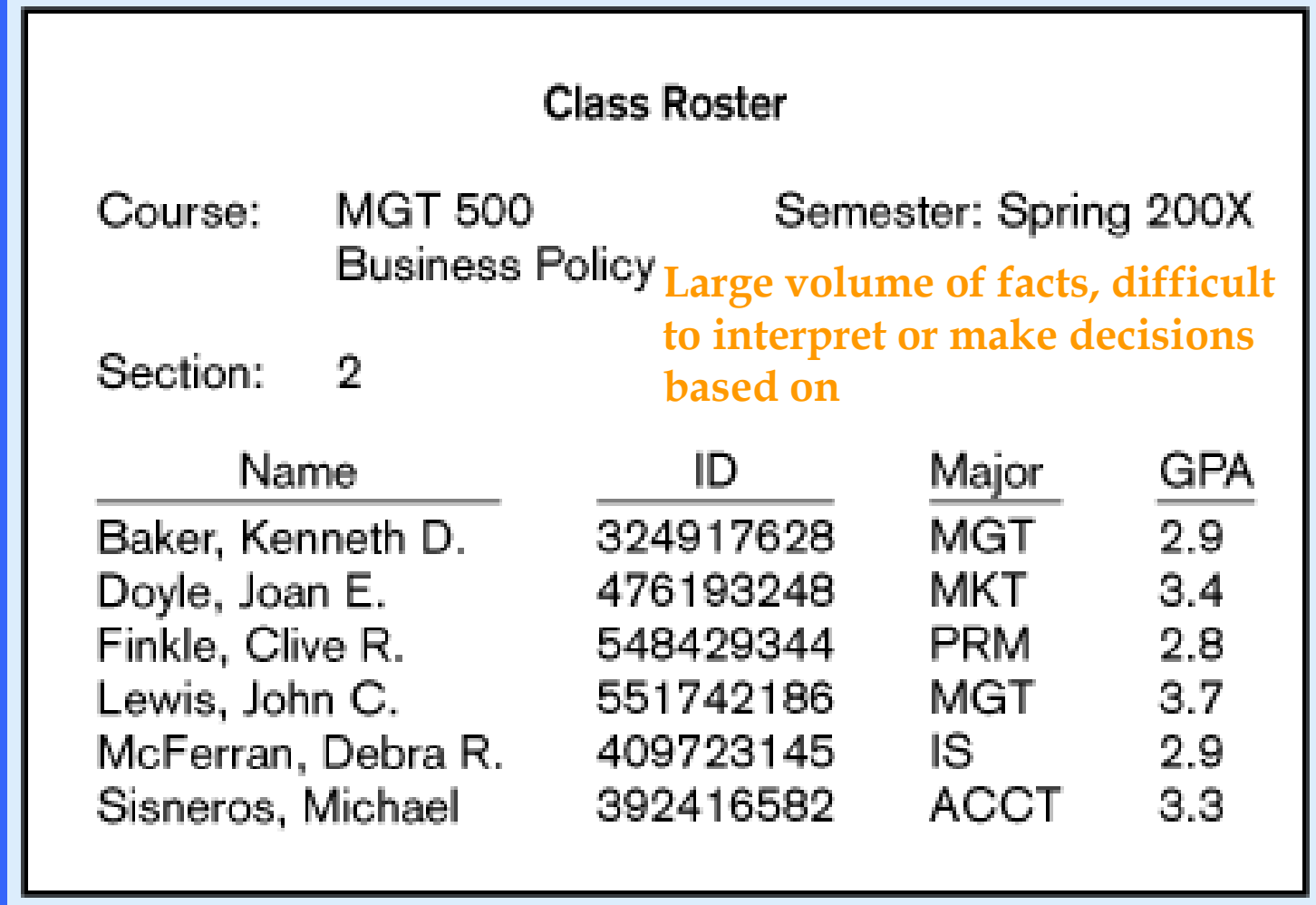
Data: Meaningful facts, text, graphics, images, sound, video segments

Database: An organized collection of logically related data

Information: Data processed to be useful in decision making

Metadata: Data that describes data

Figure 1-1a Data in Context



Class Roster

Course: MGT 500 Business Policy

Semester: Spring 200X

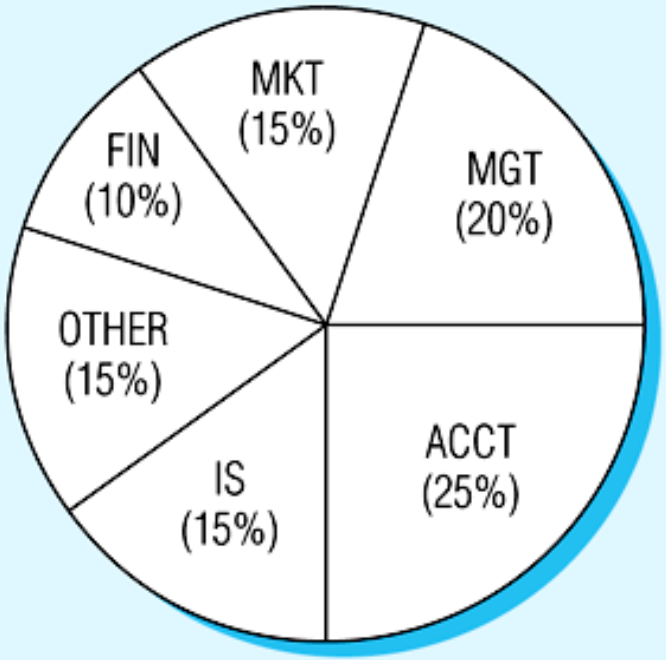
Section: 2

Large volume of facts, difficult to interpret or make decisions based on

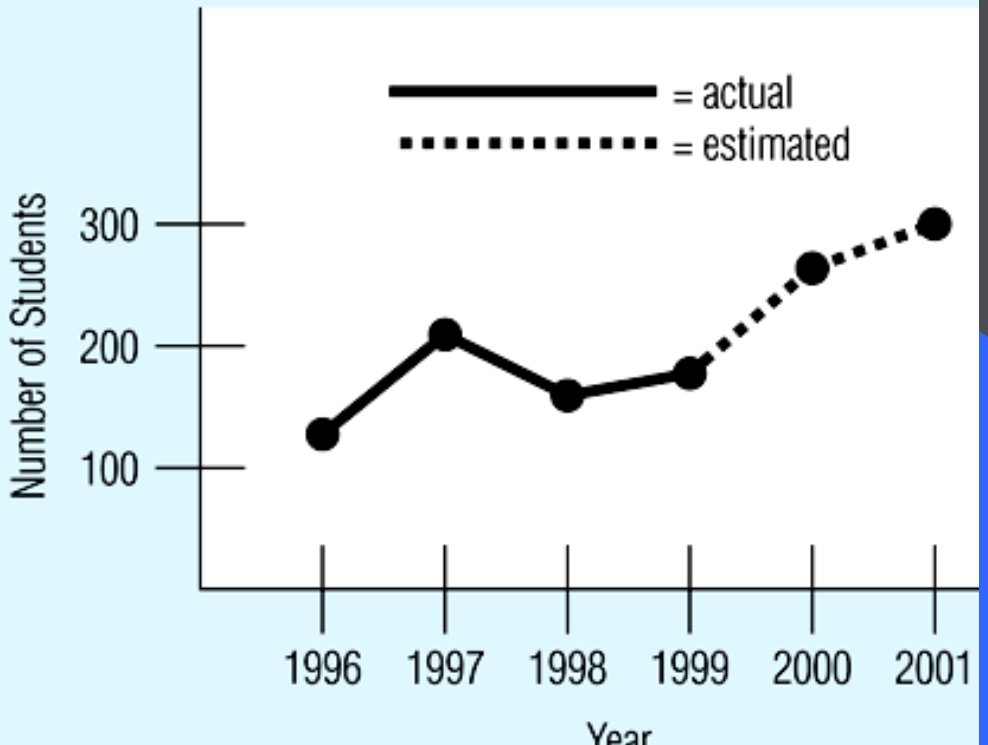
Name	ID	Major	GPA
Baker, Kenneth D.	324917628	MGT	2.9
Doyle, Joan E.	476193248	MKT	3.4
Finkle, Clive R.	548429344	PRM	2.8
Lewis, John C.	551742186	MGT	3.7
McFerran, Debra R.	409723145	IS	2.9
Sisneros, Michael	392416582	ACCT	3.3

Figure 1-1b Summarized data

Useful information that managers can use for decision making and interpretation



Percent Enrollment by Major (199X)



Enrollment Projections

Table 1-1 Metadata

Descriptions of the properties or characteristics of the data, including data types, field sizes, allowable values, and documentation

Table 1-1 Example Metadata for Class Roster

Data Item		*Value*			
Name	**Type**	**Length**	**Min**	**Max**	**Description**
Course	Alphanumeric	30			Course ID and name
Section	Integer	1	1	9	Section number
Semester	Alphanumeric	10			Semester and year
Name	Alphanumeric	30			Student name
ID	Integer	9			Student ID (SSN)
Major	Alphanumeric	4			Student major
GPA	Decimal	3	0.0	4.0	Student grade point average

Disadvantages of File Processing

Program-Data Dependence

- All programs maintain metadata for each file they use

Data Redundancy (Duplication of data)

- Different systems/programs have separate copies of the same data

Limited Data Sharing

- No centralized control of data

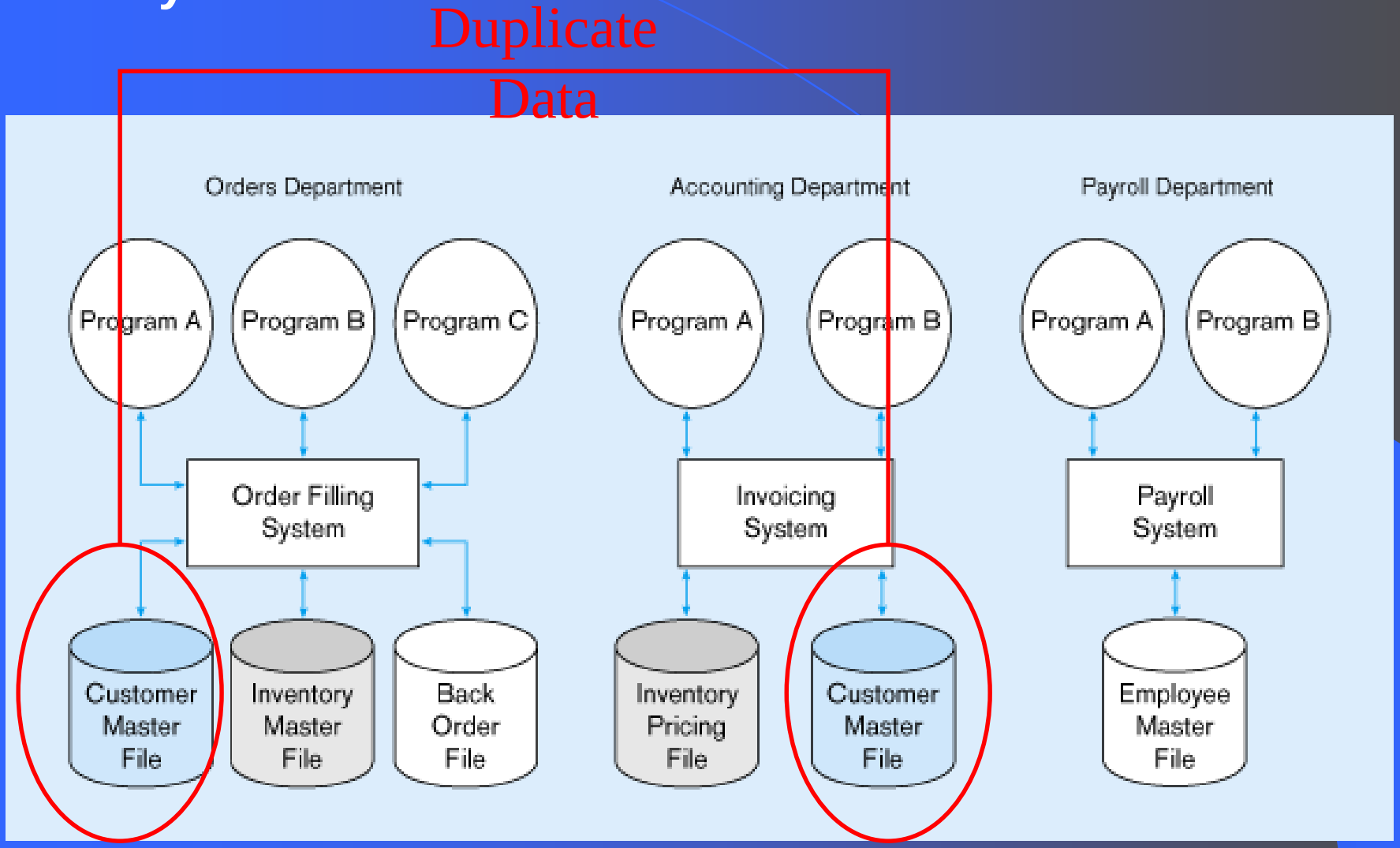
Lengthy Development Times

- Programmers must design their own file formats

Excessive Program Maintenance

- 80% of of information systems budget

Figure 1-2 Three file processing systems at Pine Valley Furniture



Problems with Data Dependency

- Each application programmer must maintain their own data
- Each application program needs to include code for the metadata of each file
- Each application program must have its own processing routines for reading, inserting, updating and deleting data
- Lack of coordination and central control
- Non-standard file formats

Problems with Data Redundancy

Waste of space to have duplicate data

Causes more maintenance headaches

The biggest Problem:

- **When data changes in one file, could cause inconsistencies**
- Compromises ***data integrity***

SOLUTION: The DATABASE Approach

Central repository of shared data

Data is managed by a controlling agent

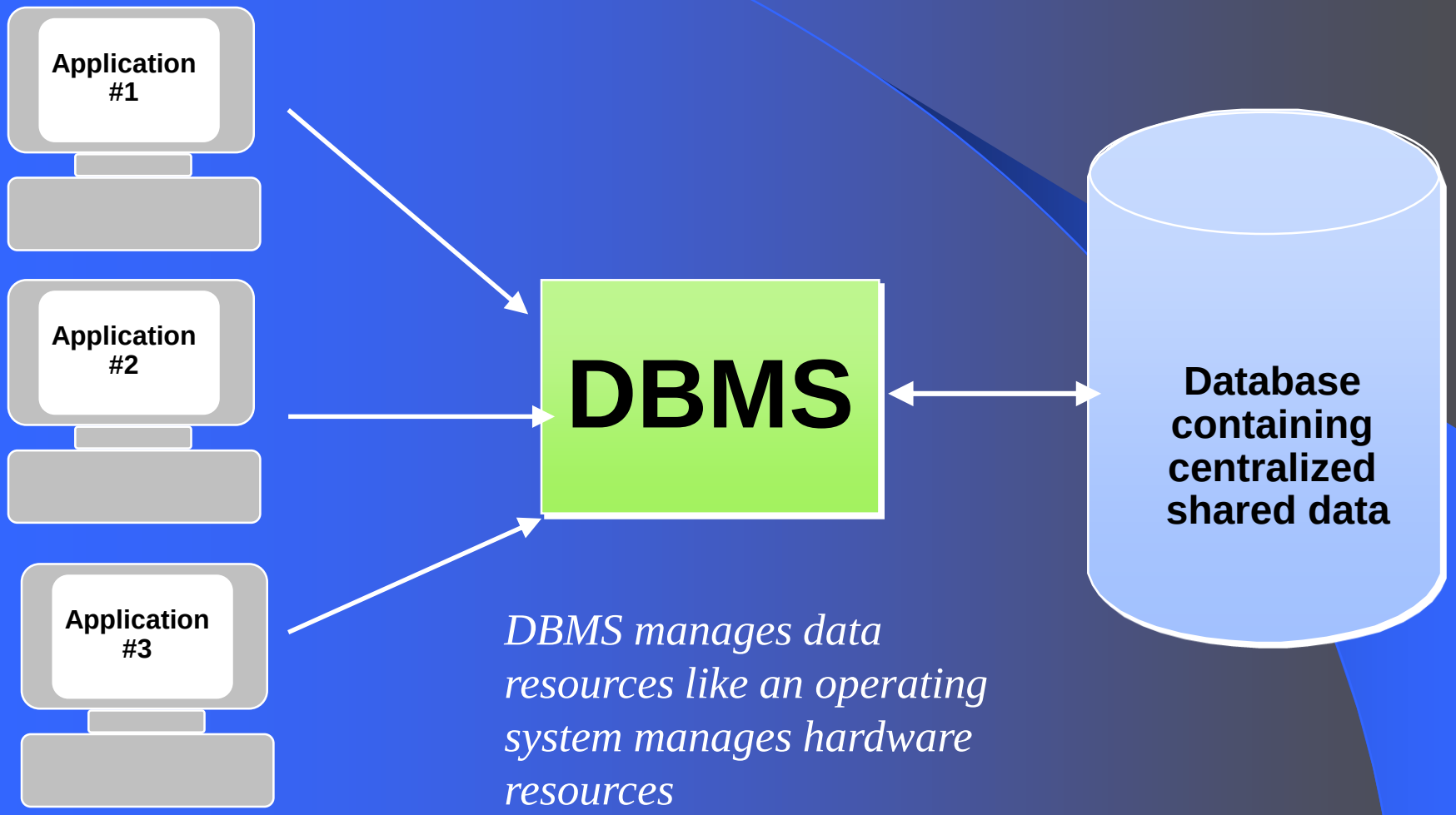
Stored in a standardized, convenient form

Requires a Database Management System (DBMS)

Database Management System

A DBMS is a data storage and retrieval system which permits data to be stored non-redundantly while making it appear to the user as if the data is well-integrated.

Database Management System



DBMS manages data resources like an operating system manages hardware resources

Advantages of Database Approach

Program-Data Independence

- Metadata stored in DBMS, so applications don't need to worry about data formats
- Data queries/updates managed by DBMS so programs don't need to process data access routines
- Results in: increased application development and maintenance productivity

Minimal Data Redundancy

- Leads to increased data integrity/consistency

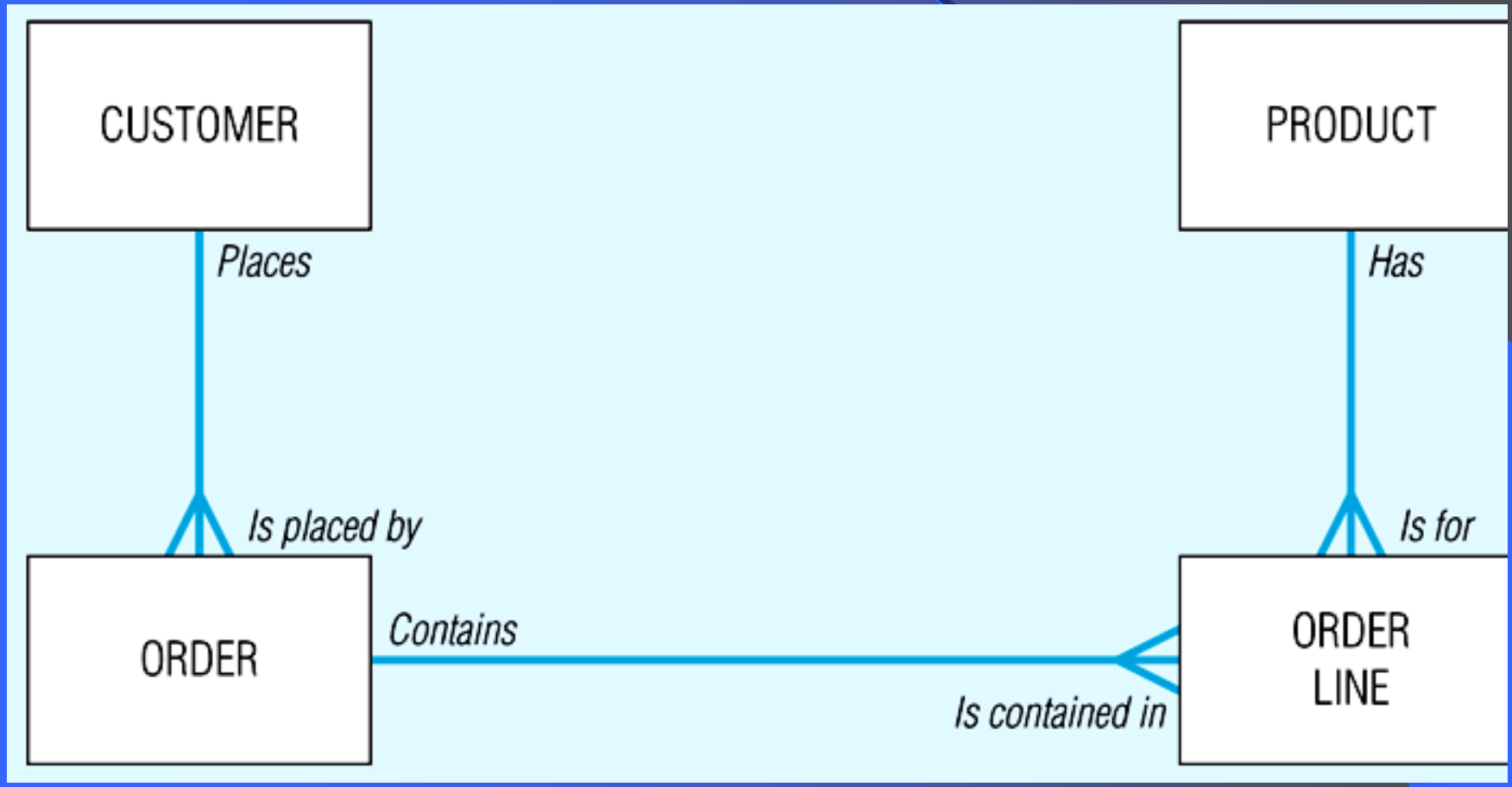
Advantages of Database Approach

- Improved Data Sharing
  - Different users get different views of the data
- Enforcement of Standards
  - All data access is done in the same way
- Improved Data Quality
  - Constraints, data validation rules
- Better Data Accessibility/ Responsiveness
  - Use of standard data query language (SQL)
- Security, Backup/Recovery, Concurrency
  - Disaster recovery is easier

Costs and Risks of the Database Approach

- Up-front costs:
  - Installation Management Cost and Complexity
  - Conversion Costs
- Ongoing Costs
  - Requires New, Specialized Personnel
  - Need for Explicit Backup and Recovery
- Organizational Conflict
  - Old habits die hard

Figure 1-3 Segment from enterprise data model



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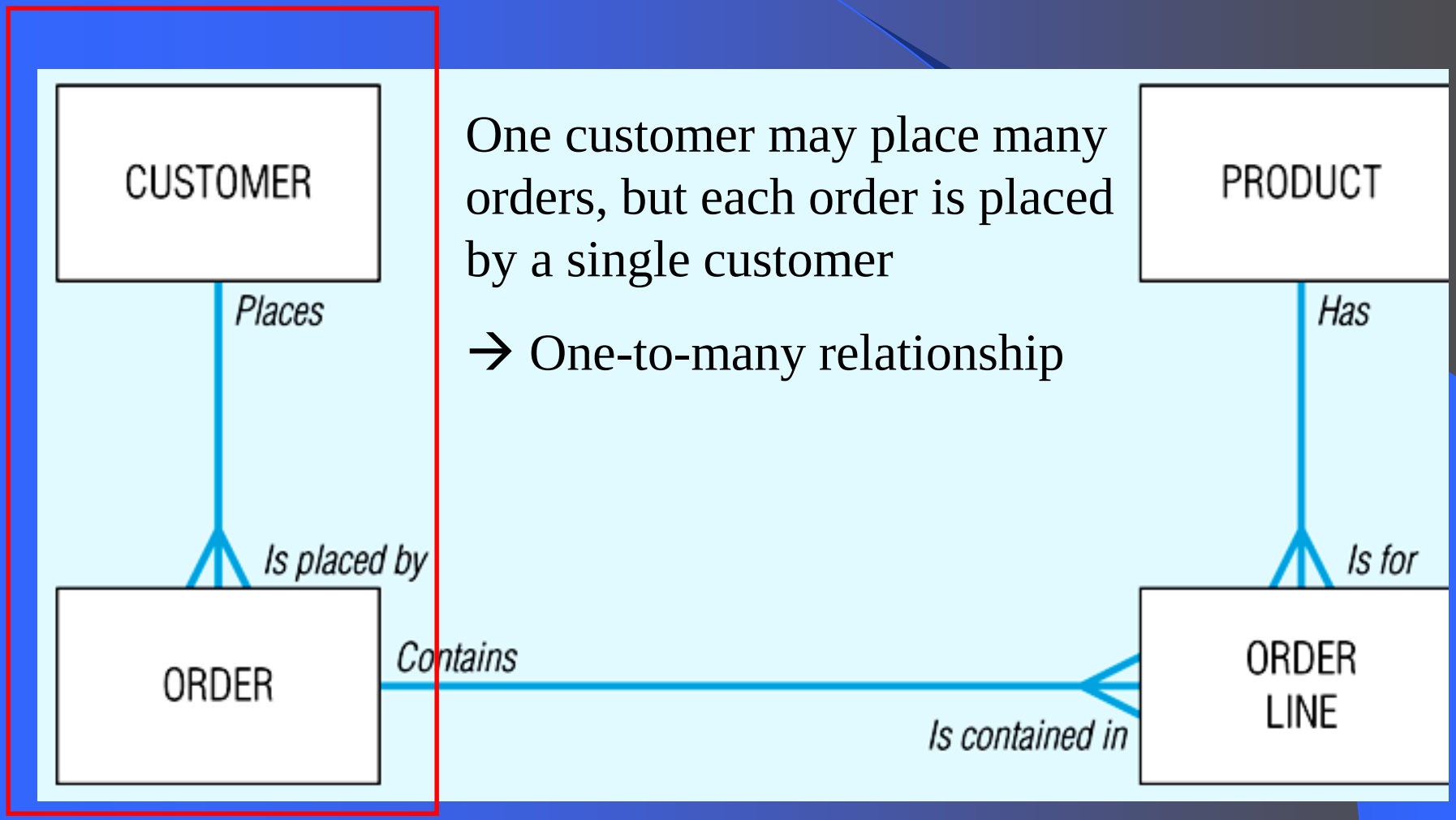

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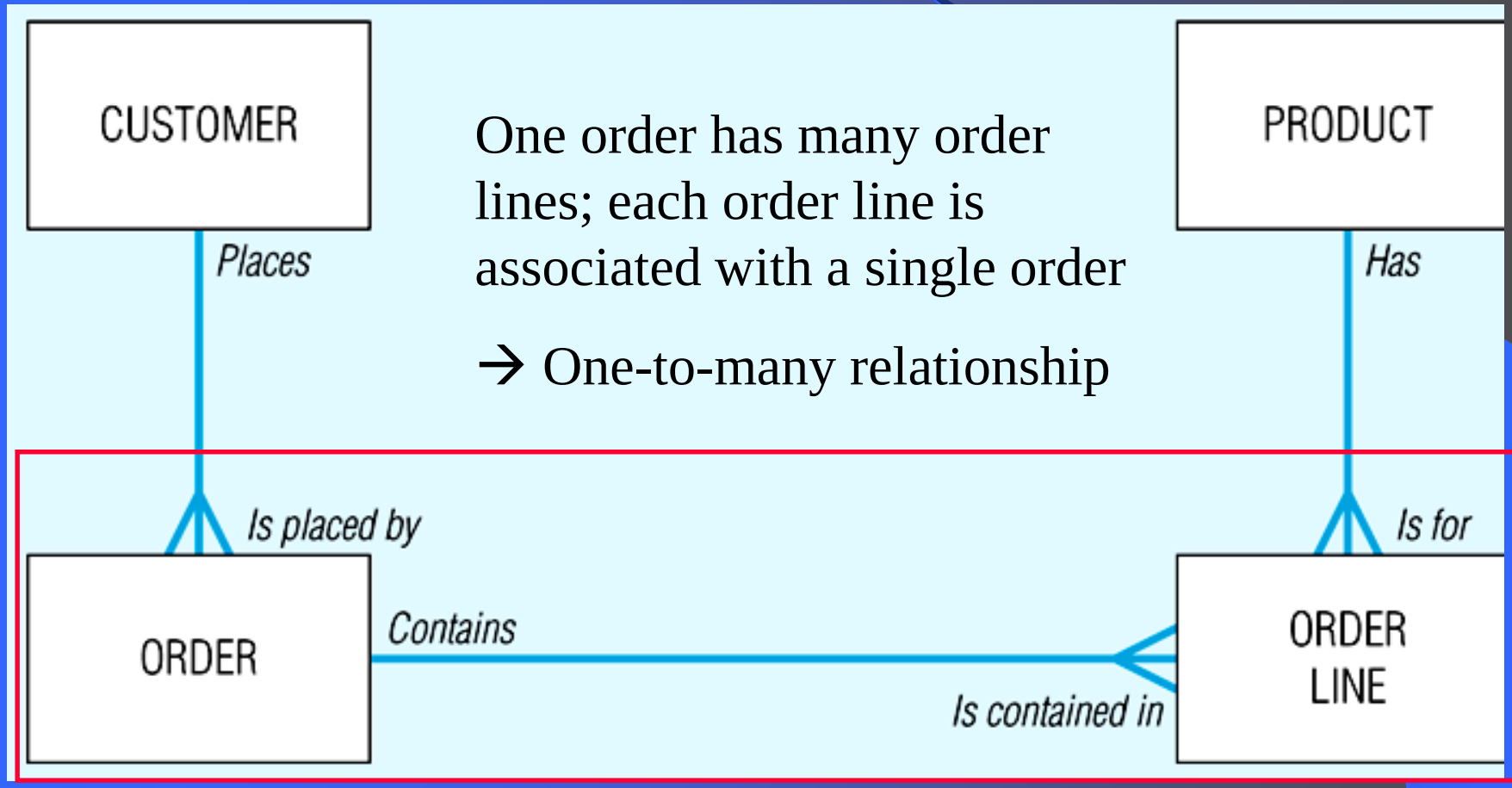

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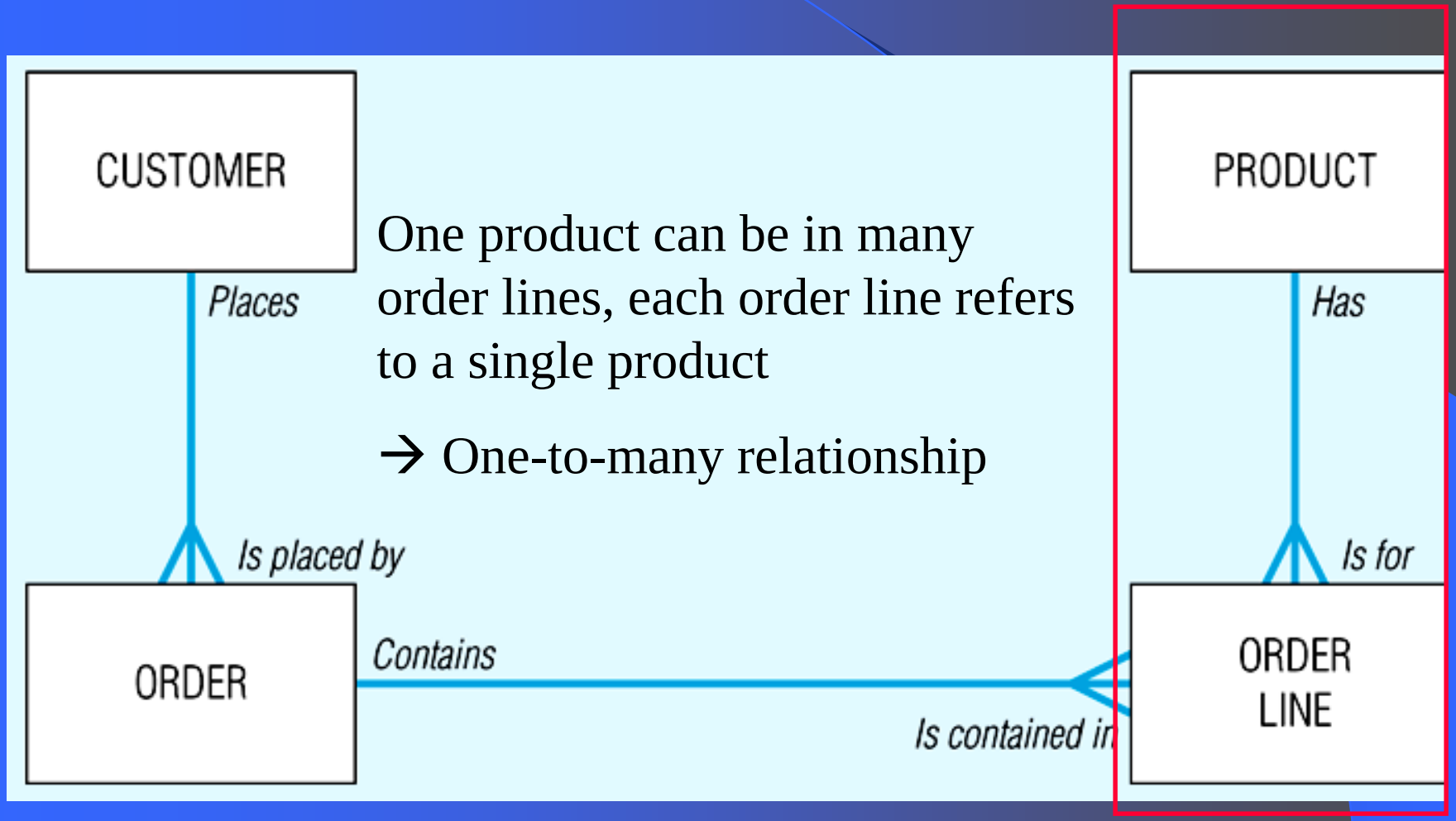


Figure 1-3 Segment from enterprise data model

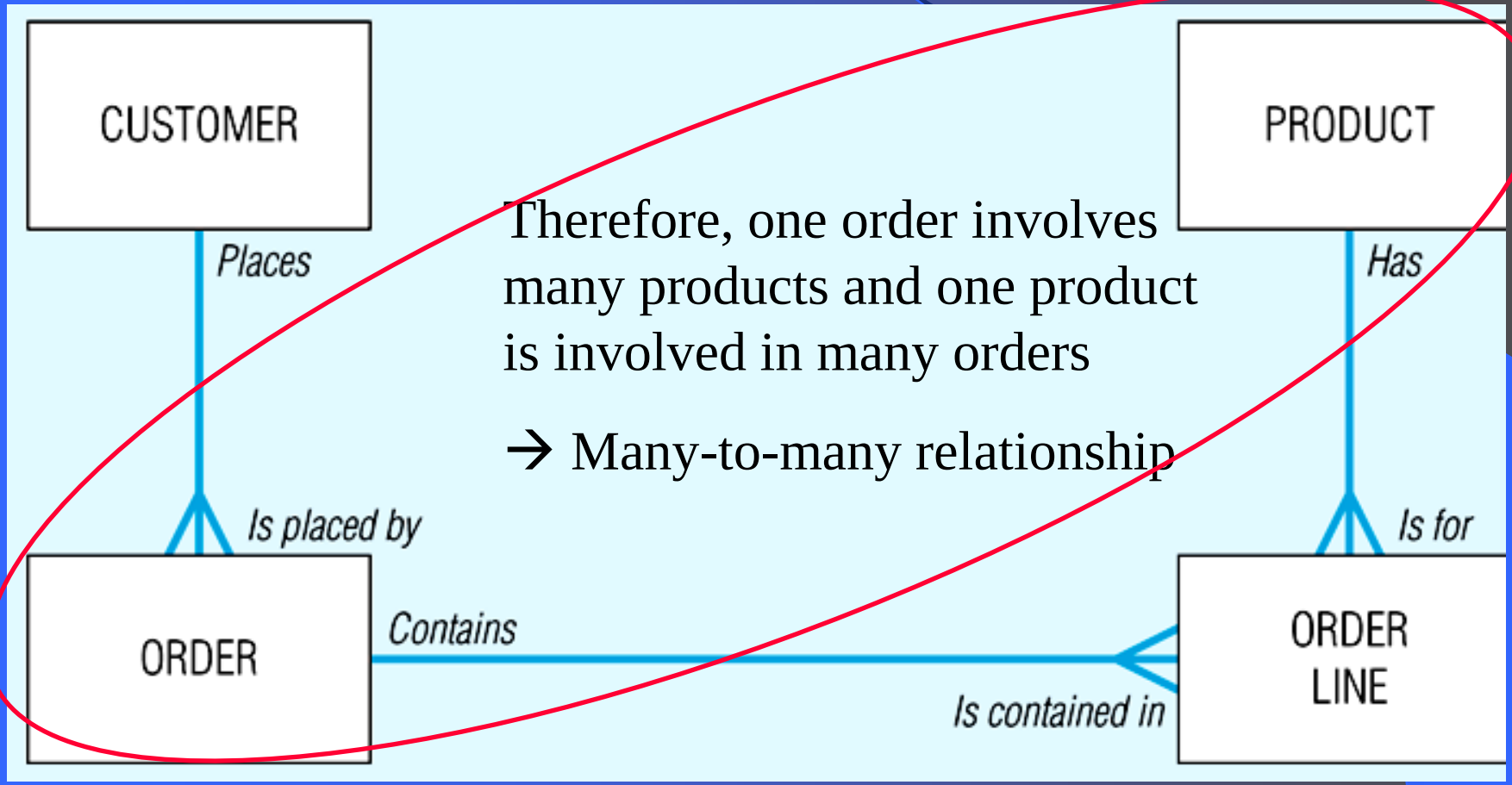


Figure 1-4 Order, Order_Line, Customer, and Product tables

Relationships established in special columns that provide links between tables

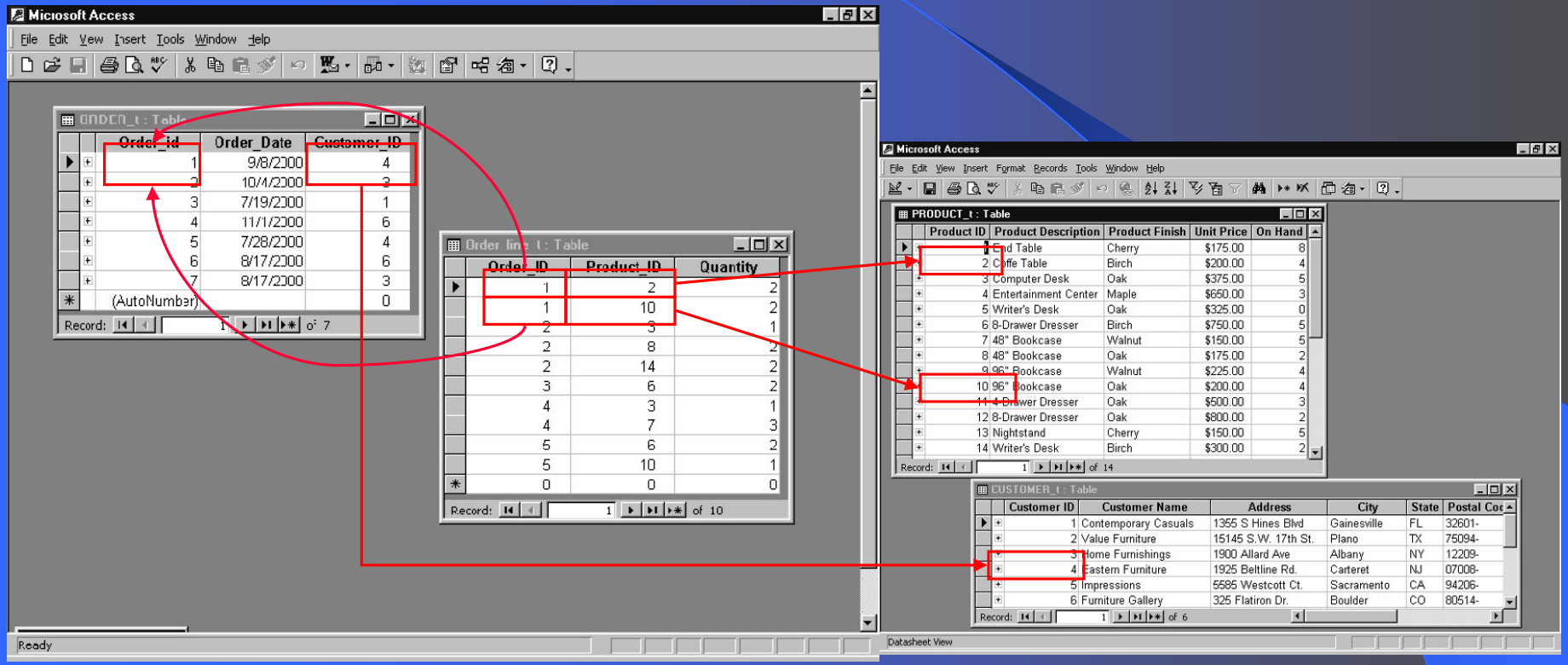


Figure 1-5 Client/server system for Pine Valley Furniture Company

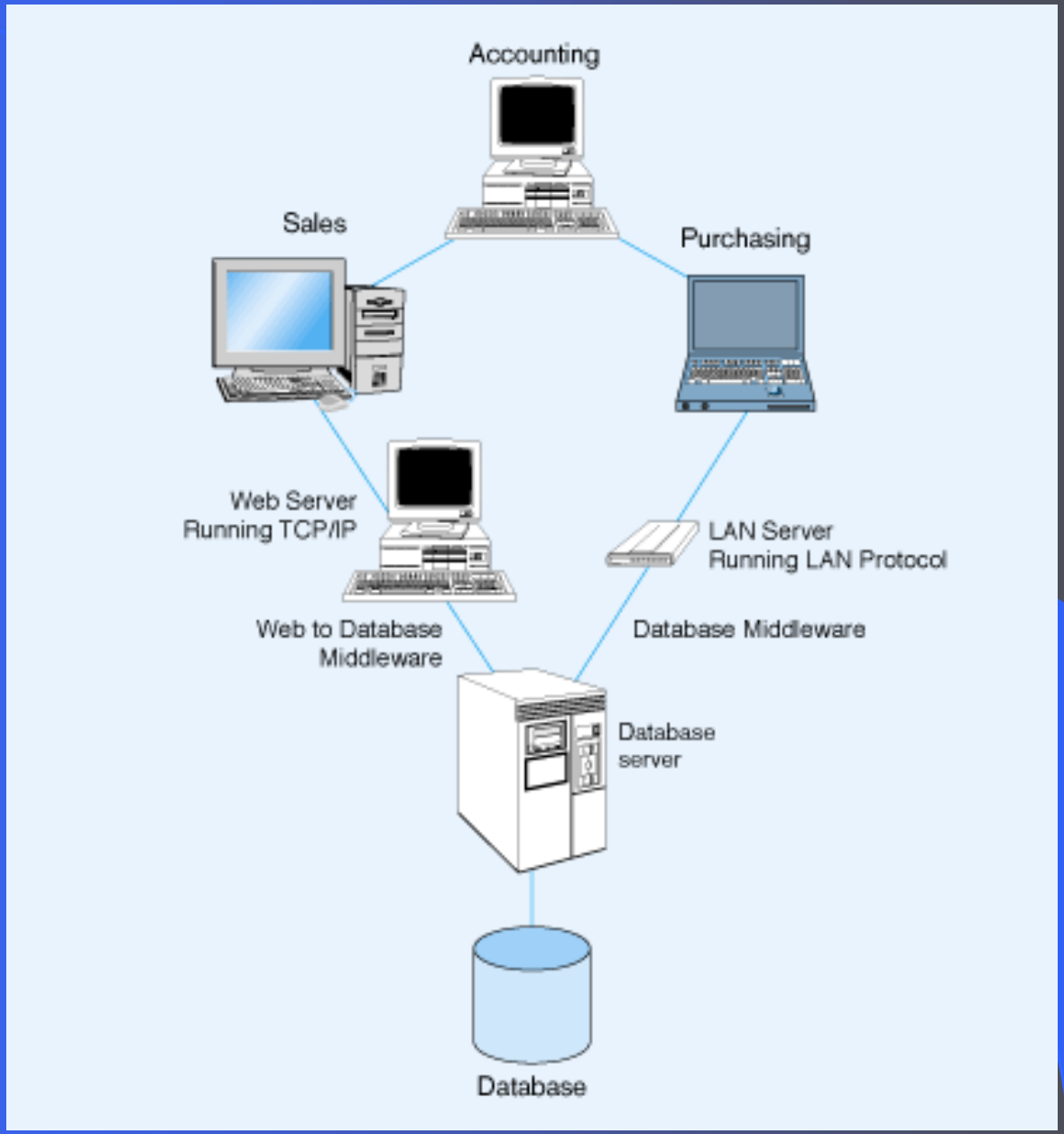
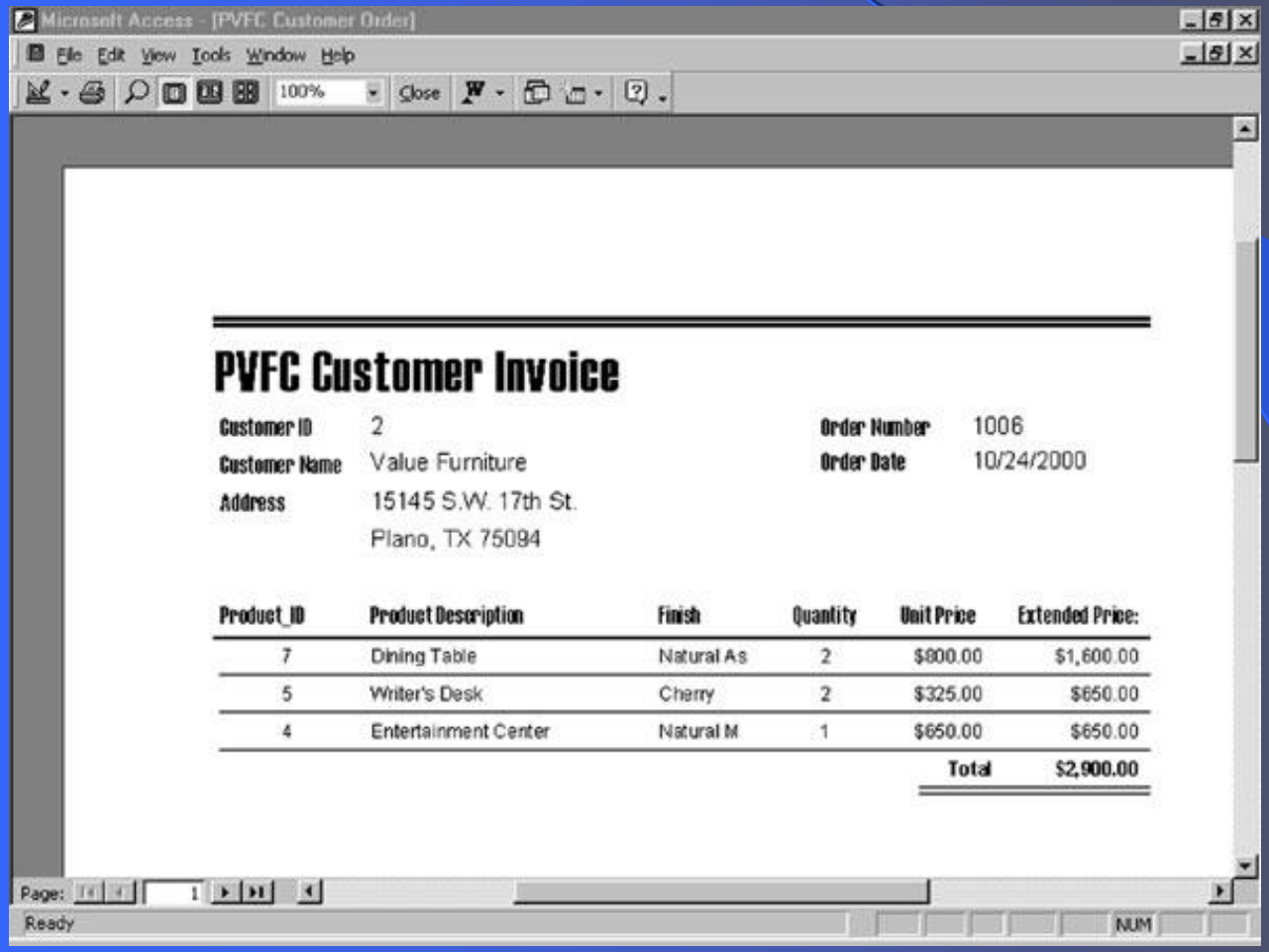


Figure 1-6 Customer invoice (Pine Valley Furniture Company)

Application program functions:

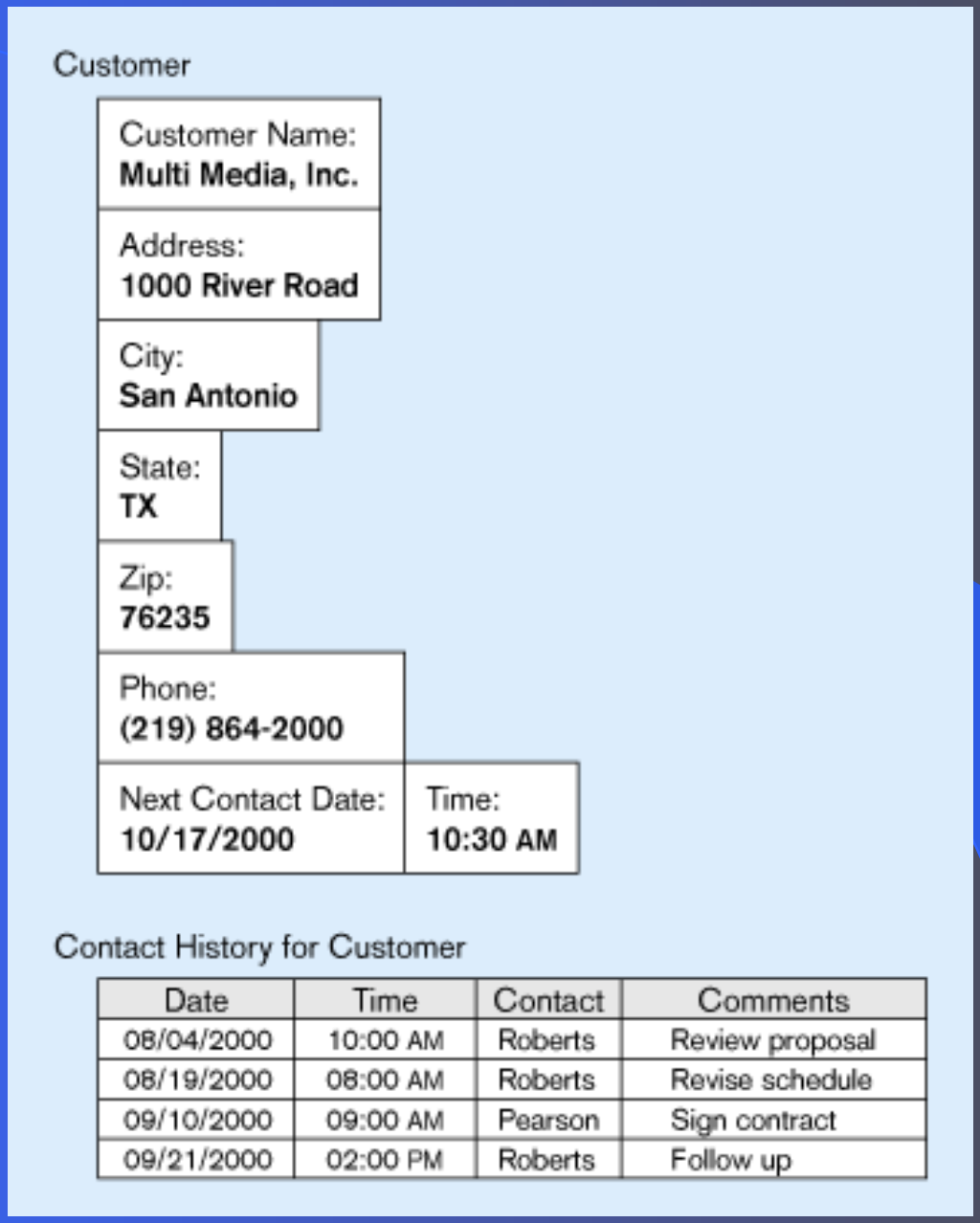
inserting new data, updating existing data,
deleting existing data, reading data for display



The Range of Database Applications

- Personal Database – standalone desktop database
- Workgroup Database – local area network (<25 users)
- Department Database – local area network (25-100 users)
- Enterprise Database – wide-area network (hundreds or thousands of users)

Figure 1-7 Typical data from a personal computer database



Date	Time	Contact	Comments
08/04/2000	10:00 AM	Roberts	Review proposal
08/19/2000	08:00 AM	Roberts	Revise schedule
09/10/2000	09:00 AM	Pearson	Sign contract
09/21/2000	02:00 PM	Roberts	Follow up

Figure 1-8 Workgroup database with local area network

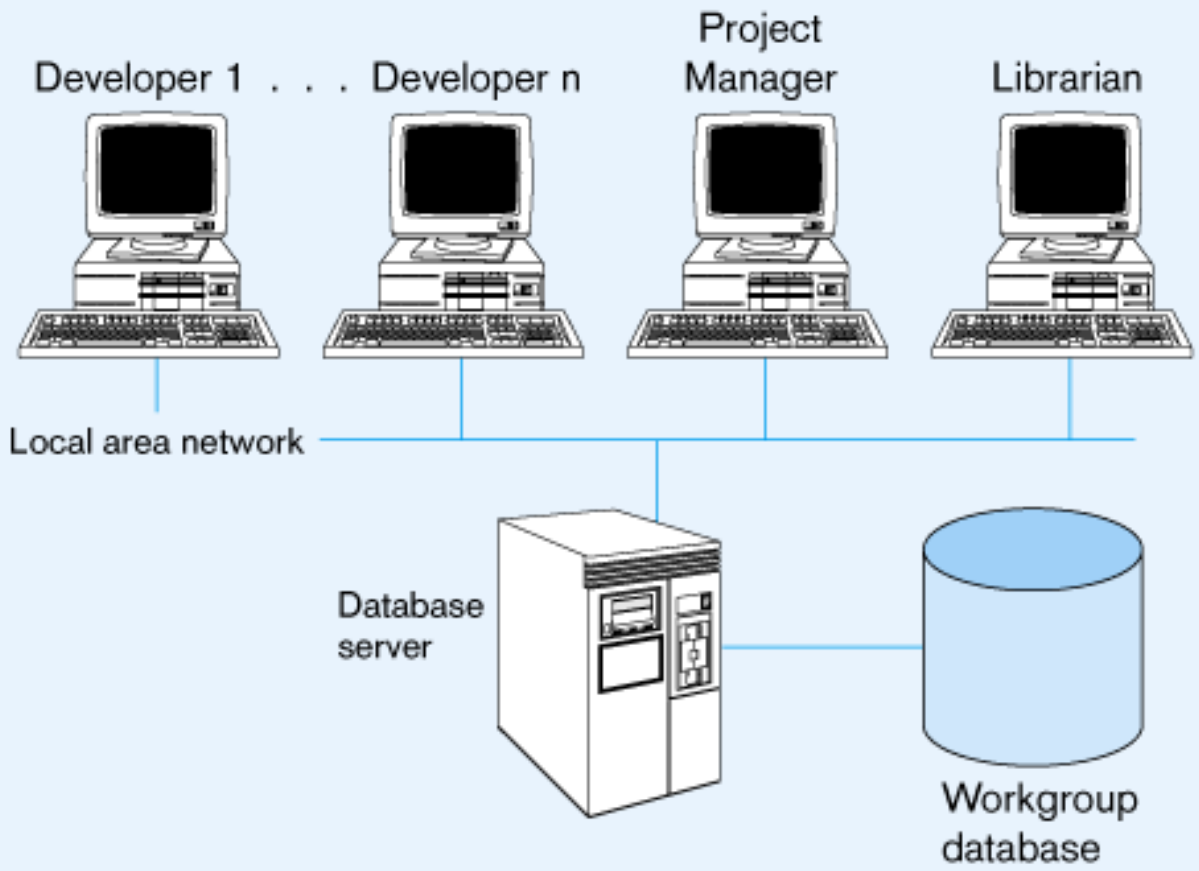
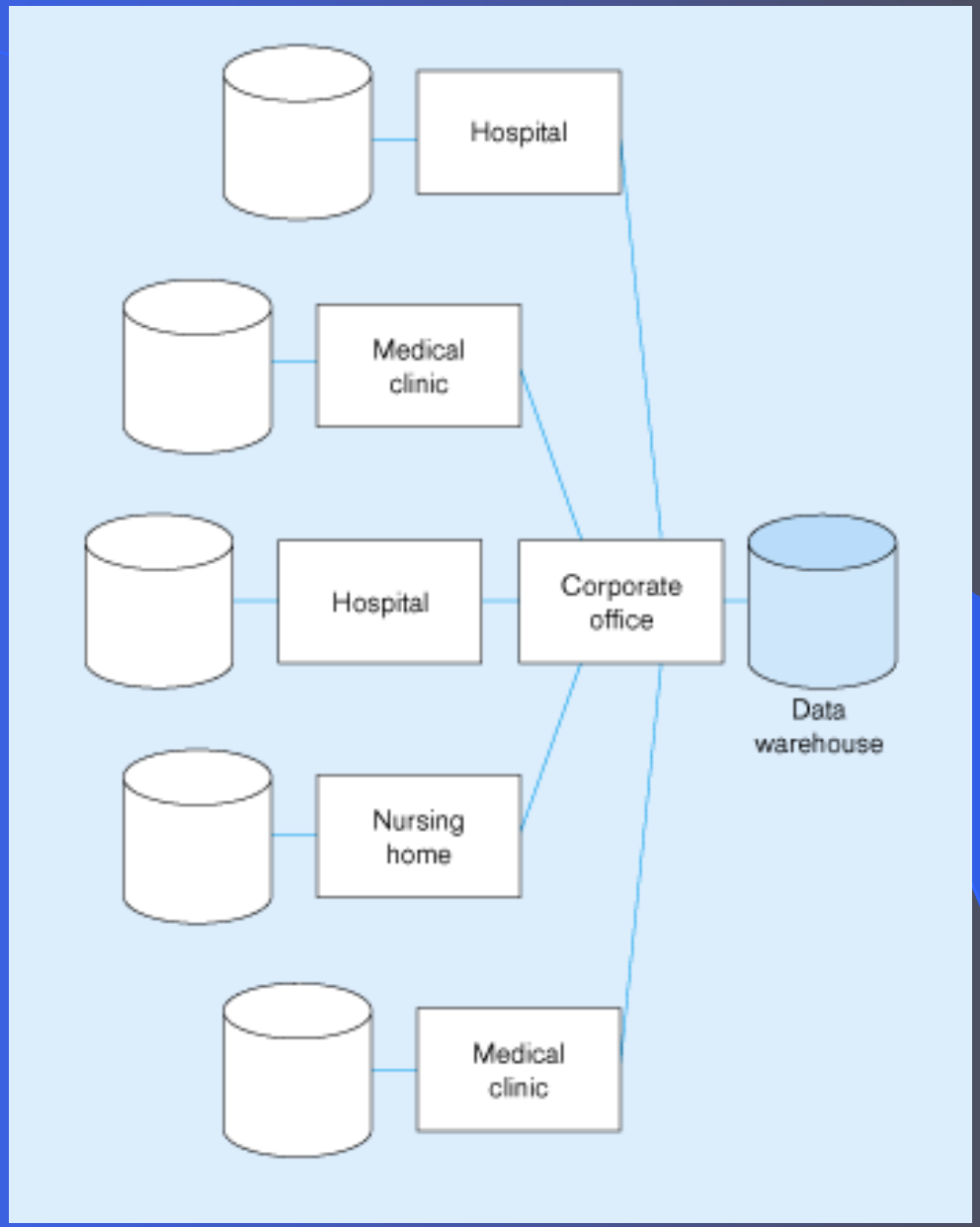


Figure 1-9 An enterprise data warehouse



Components of the Database Environment

CASE Tools – computer-aided software engineering

Repository – centralized storehouse of metadata

Database Management System (DBMS) – software for managing the database

Database – storehouse of the data

Application Programs – software using the data

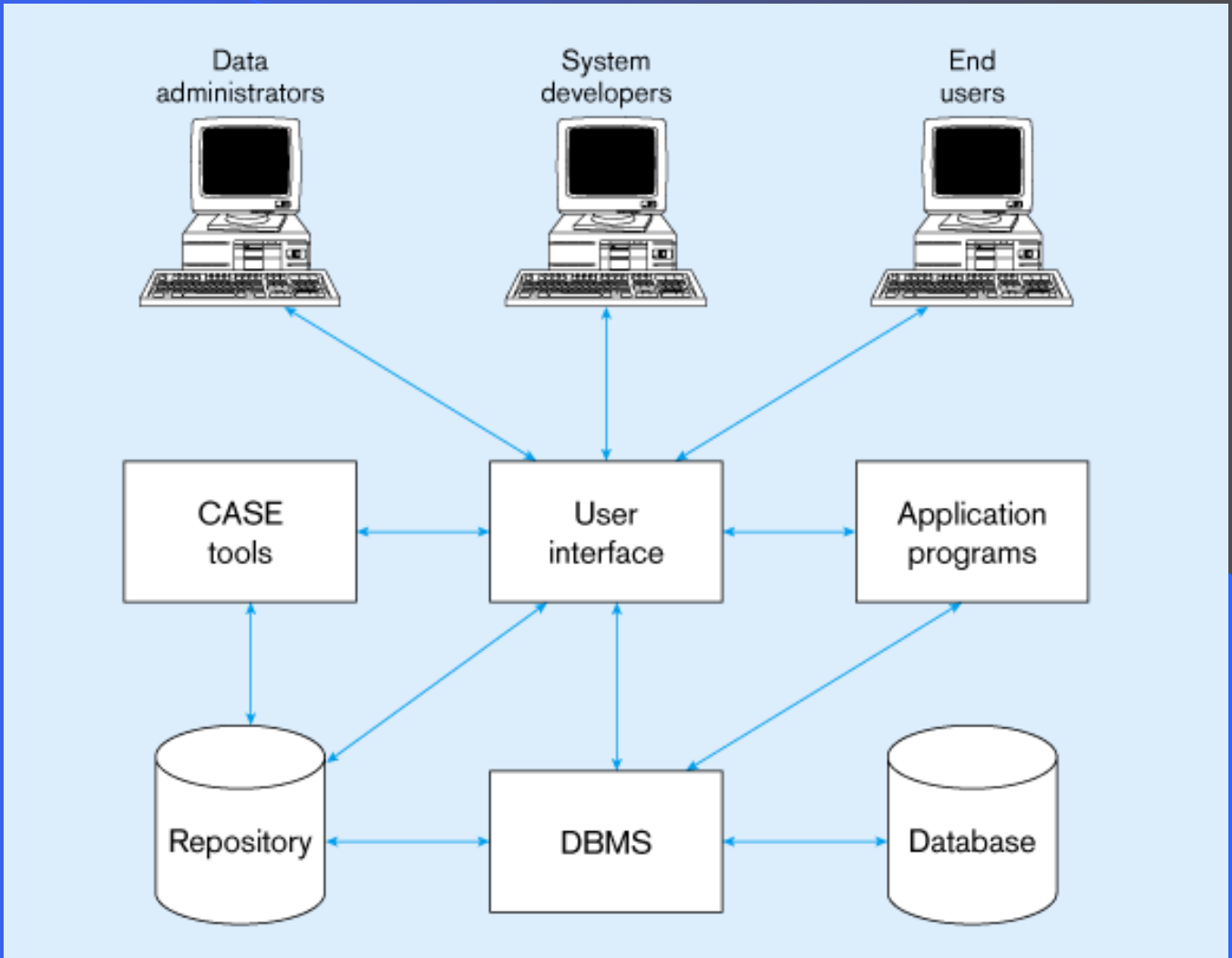
User Interface – text and graphical displays to users

Data Administrators – personnel responsible for maintaining the database

System Developers – personnel responsible for designing databases and software

End Users – people who use the applications and databases

Figure 1-10 Components of the database environment



Evolution of DB Systems

- Flat files - 1960s - 1980s
- Hierarchical – 1970s - 1990s
- Network – 1970s - 1990s
- Relational – 1980s - present
- Object-oriented – 1990s - present
- Object-relational – 1990s - present
- Data warehousing – 1980s - present
- Web-enabled – 1990s - present