Database Environment

DAT-BAS

September 2013

Agenda

- Familiarization of Database terms
- File Processing Systems
- Database Approach
- Database in Relation to Information System (IS)

What is a Database?

◆ **Connolly et al**

Shared collection of <u>logically related data</u>, and a *description of this data*, designed to meet the *information needs* of an organization

◆ **Hoffer et al**

Organized collection of <u>logically related data</u>

What are everyday examples of a database?

1. Lookup a phone no. in the yellow pages
2. Deposit in a bank
3. Pay for a purchase using a credit card
4. Buy groceries from a supermarket
5. Use a school library
6. Enroll in classes in your university

What is Data?

- Stored representations of objects and events that have meaning and importance in the user's environment
- Each data item is stored in its own <u>field (column)</u>
  - E.g. first name, date of birth
- Fields relating to 1 particular person, thing or event are bundled together to form a single complete unit of data called <u>record (row)</u>

What is Information?

- Data that have been processed in such a way as to increase the knowledge of the person who uses the data
  - Example

    Marivic Tangkeko is the professor in-charge of DATASQL.

What is Metadata?

- Data that describe the properties or characteristics of end-user data, and the context of that data
  - Example

    Fname   first name   size(45)   alphanumeric

    DOB   date of birth   size(8)   date

- Also refers to as system catalog or data dictionary

DATA vis-a-vis INFORMATION

Class Roster

Course: MGT 500   Semester: Spring 200X
   Business Policy

Section: 2

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

Context helps users understand data

Converting DATA into INFORMATION

Percent Enrollment by Major (200X)

Enrollment Projections
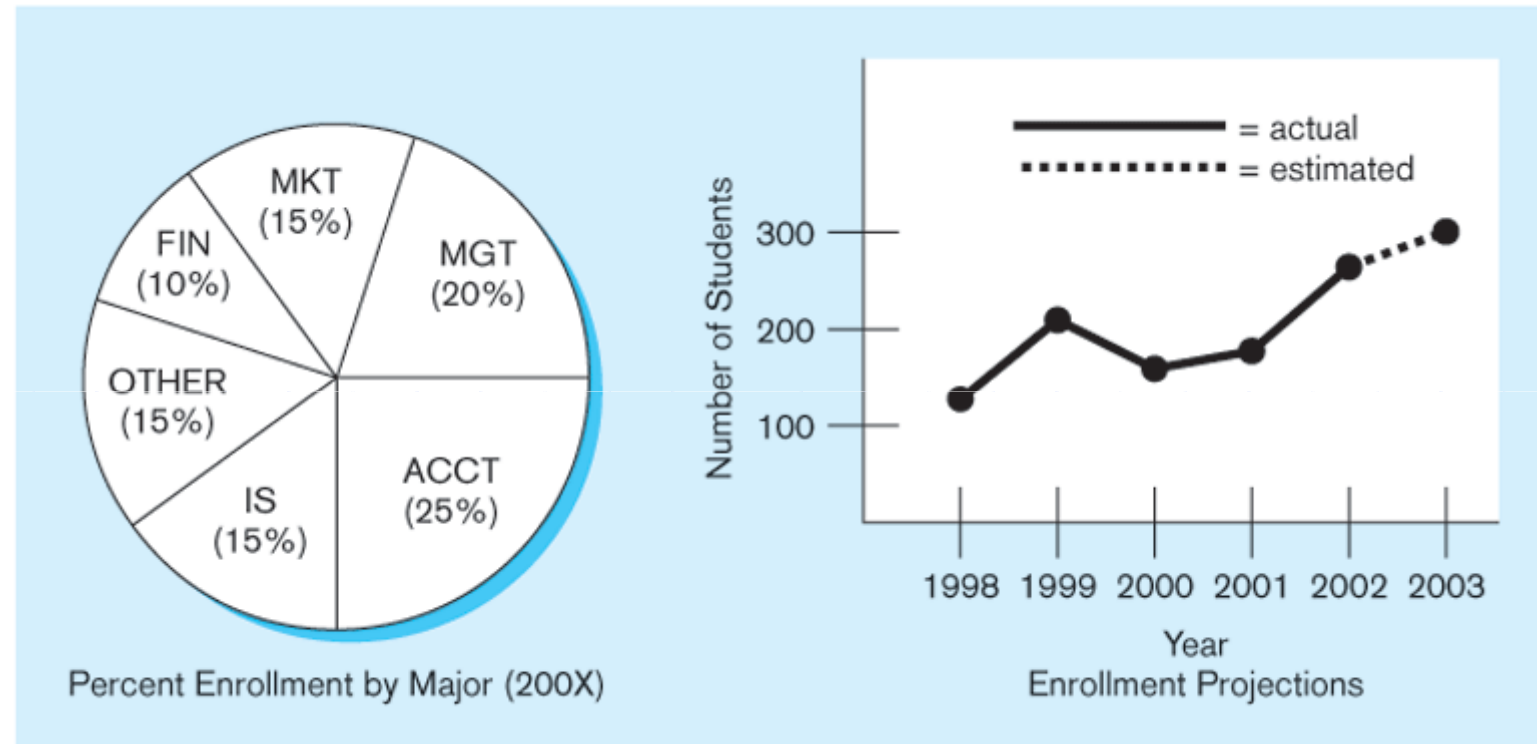
Graphical displays turn data into useful information that managers can use for decision making and interpretation

Sample METADATA

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

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

What is File-based System?

- A collection of application programs that perform services for the end-users such as the production of reports. Each program defines and manages its own data. (Connolly)

- Simplest terms
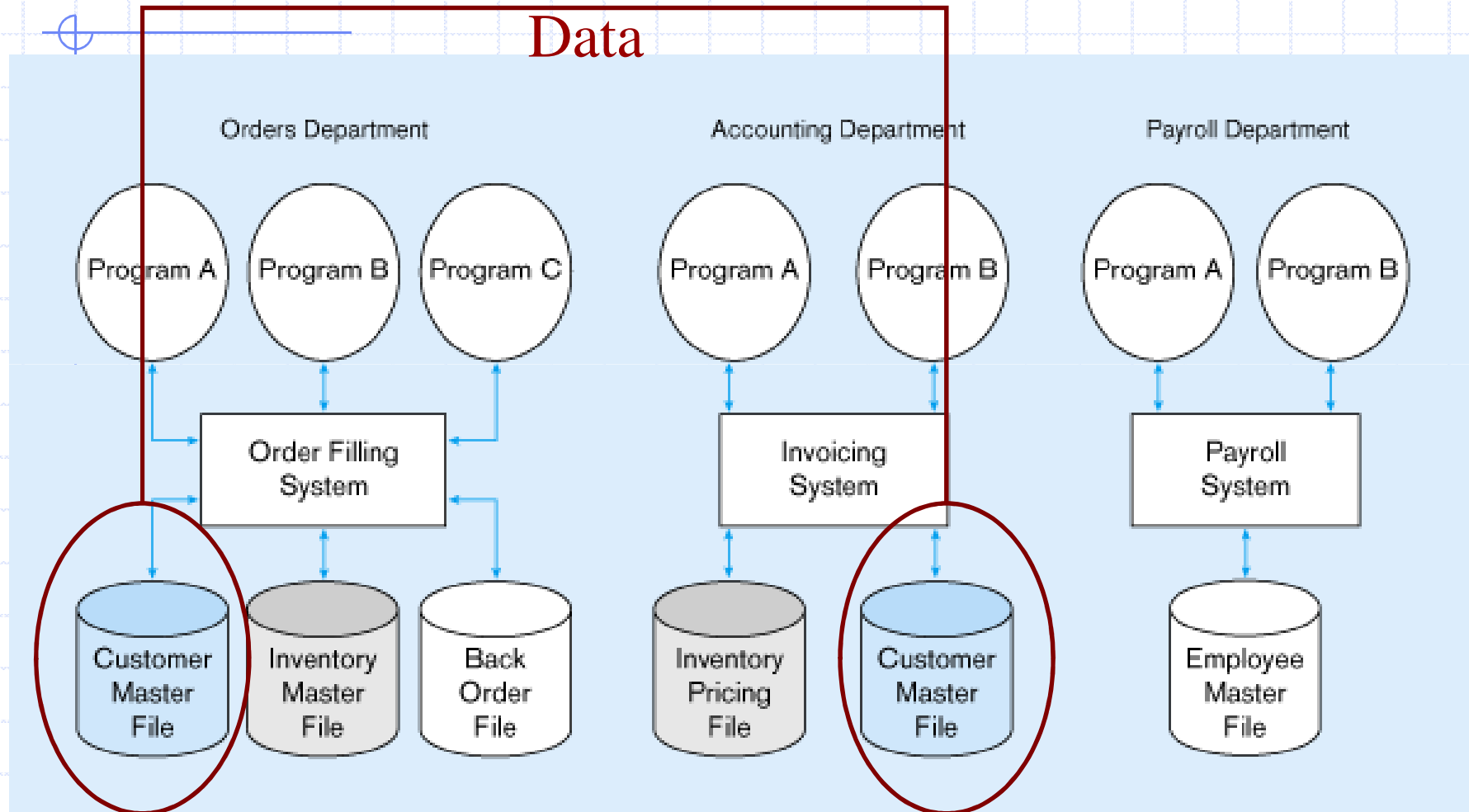 - Early attempt to computerize the manual filing system – Storage cabinets with folders, files and labels

Best example of a non-computerize database:

- ◈ **ROLODEX CARD FILE**
  - ▪ **Contains name (last name, first name), phone number (house, office, mobile) and address (house, office)**
  - ▪ **Positive: Separate contacts alphabetical**
  - ▪ **Negative: Difficult to find somebody by other pieces of information like first name or office address**

Sample processing systems

Duplicate
Data

Orders Department

Program A   Program B   Program C

Order Filling
System

Customer
Master
File

Inventory
Master
File

Back
Order
File

Accounting Department

Program A   Program B

Invoicing
System

Inventory
Pricing
File

Customer
Master
File

Payroll Department

Program A   Program B

Payroll
System

Employee
Master
File

Disadvantages of File Processing

- **Program-Data Dependence**
  - All programs maintain metadata for each file they use
- **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

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

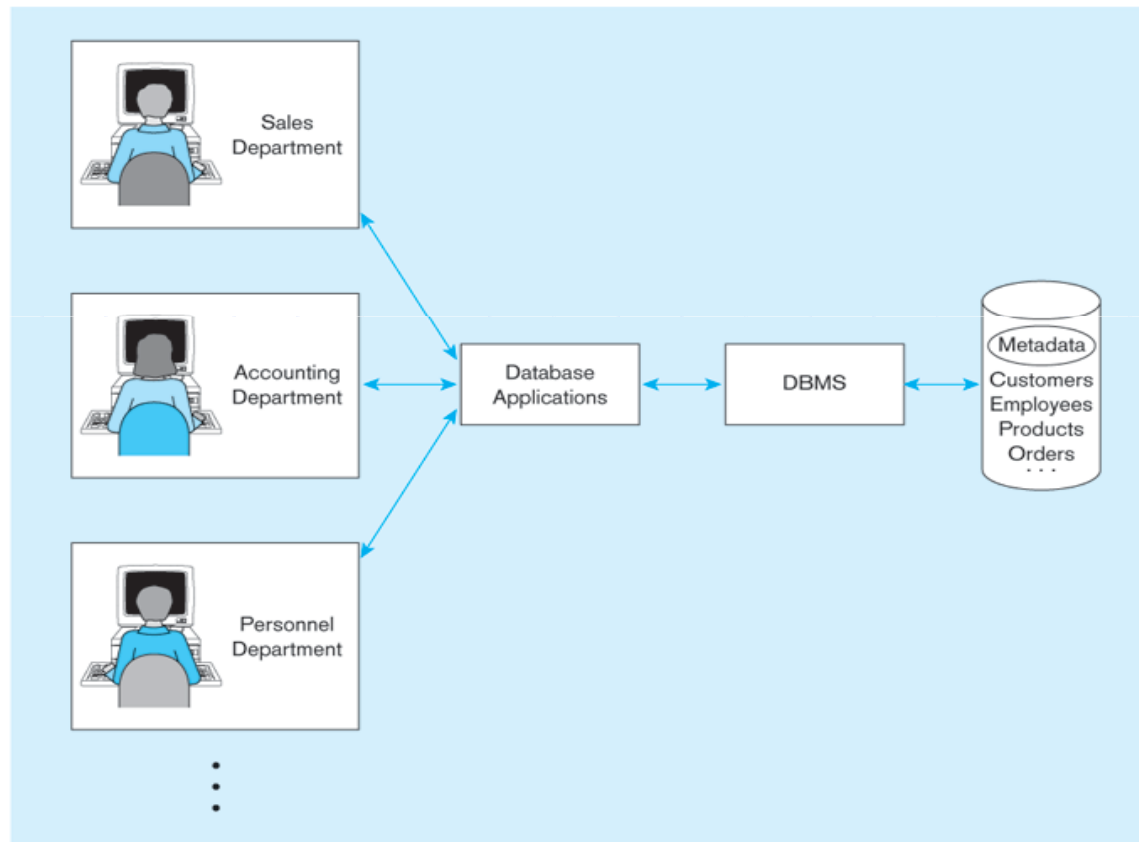Requires a Database Management System (DBMS)

What is a Database Management System (DBMS)?

- ◆ **Connolly et al**

  Software system that enables users to define, create, maintain and control access to the database

- ◆ **Hoffer et al**

  - Software system that is used to create, maintain, and provide controlled access to user databases

Database Management System

DBMS manages data resources like an operating system manages hardware resources

What are the facilities of a DBMS?

◆ Data Definition Language (DDL)

  ■ Allows users to define the database like specify the data types and structures and the constraints on the data

◆ Data Manipulation Language (DML)

  ■ Allows users to insert, update, delete and retrieve data from the database

◆ Query Language

  ■ Provide general inquiry facility

Database Processing

Sales

Contracts

**Sales
Application
Programs**

**Contracts
Application
Programs**

Data entry
and reports

Data entry
and reports

DBMS

**PropertyForRent,
PrivateOwner, Client
and Lease details
+ File definitions**
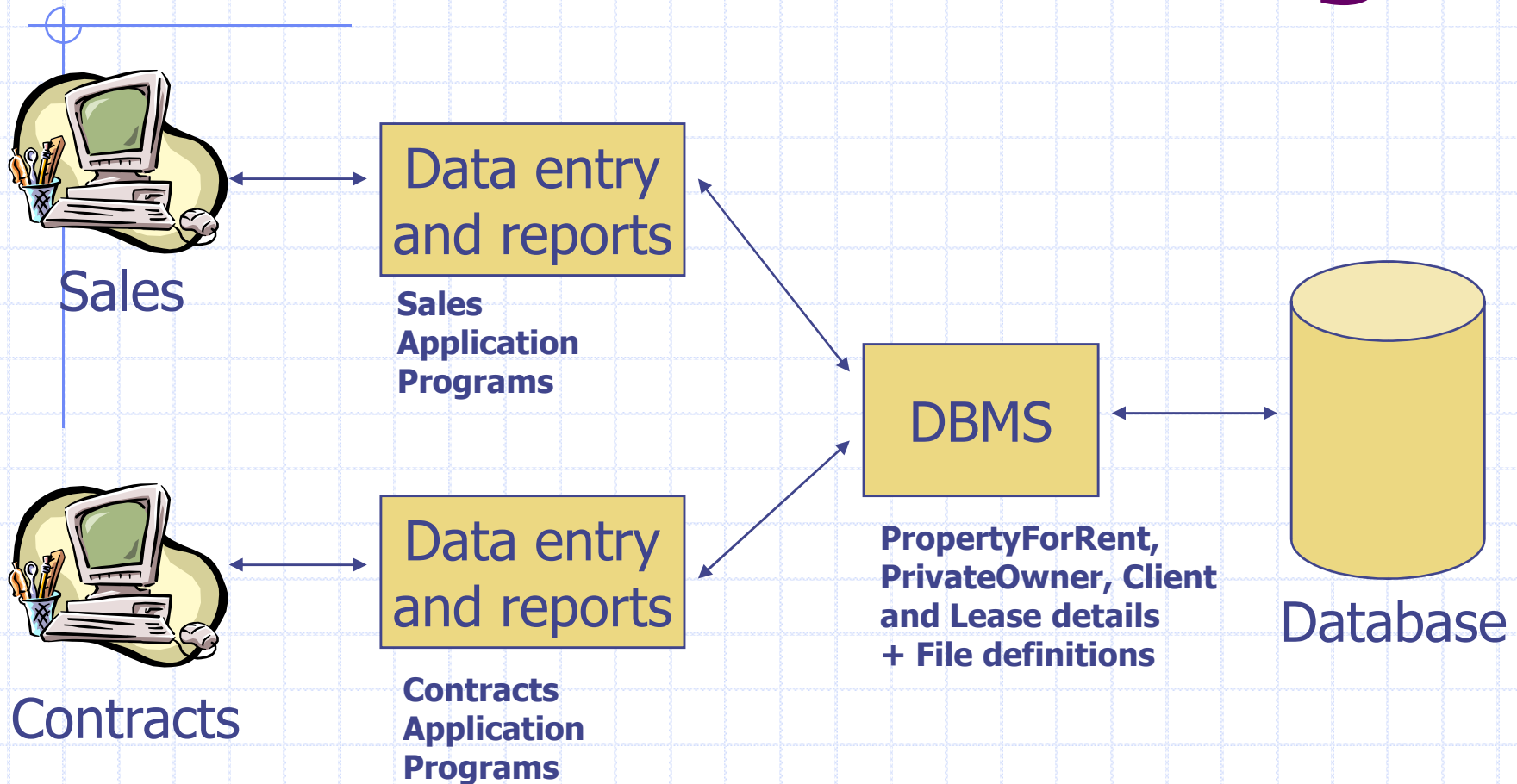
Database

Advantages of the Database Approach

- ◆ Program-Data Independence
- ◆ Minimal Data Redundancy
- ◆ Improved Data Consistency
- ◆ Improved Data Sharing
- ◆ Increased Productivity of Application Development

Advantages of the Database Approach

- Enforcement of Standards
- Improved Data Quality
- Improved data Accessibility and Responsiveness
- Reduced Program Maintenance
- Improved Decision Support

Drawbacks of the Database Approach

- New, Specialized personnel
- Installation and Management Cost and Complexity
- Conversion Costs
- Need for Explicit Backup and Recovery
- Organizational Conflict

Elements of the Database Approach

- ◈ **Enterprise Data Model**
  - ■ Graphical model showing high-level entities and relationships for the organization
- ◈ **Relational Databases**
  - ■ Database technology involving tables (relations) representing entities and primary/foreign keys representing relationships
- ◈ **Use of Internet Technology**
  - ■ Networks and telecommunications, distributed databases, client-server and 3-tier architectures
- ◈ **Database Applications**
  - ■ Application programs used to perform database activities (create, read, update, and delete) for database users
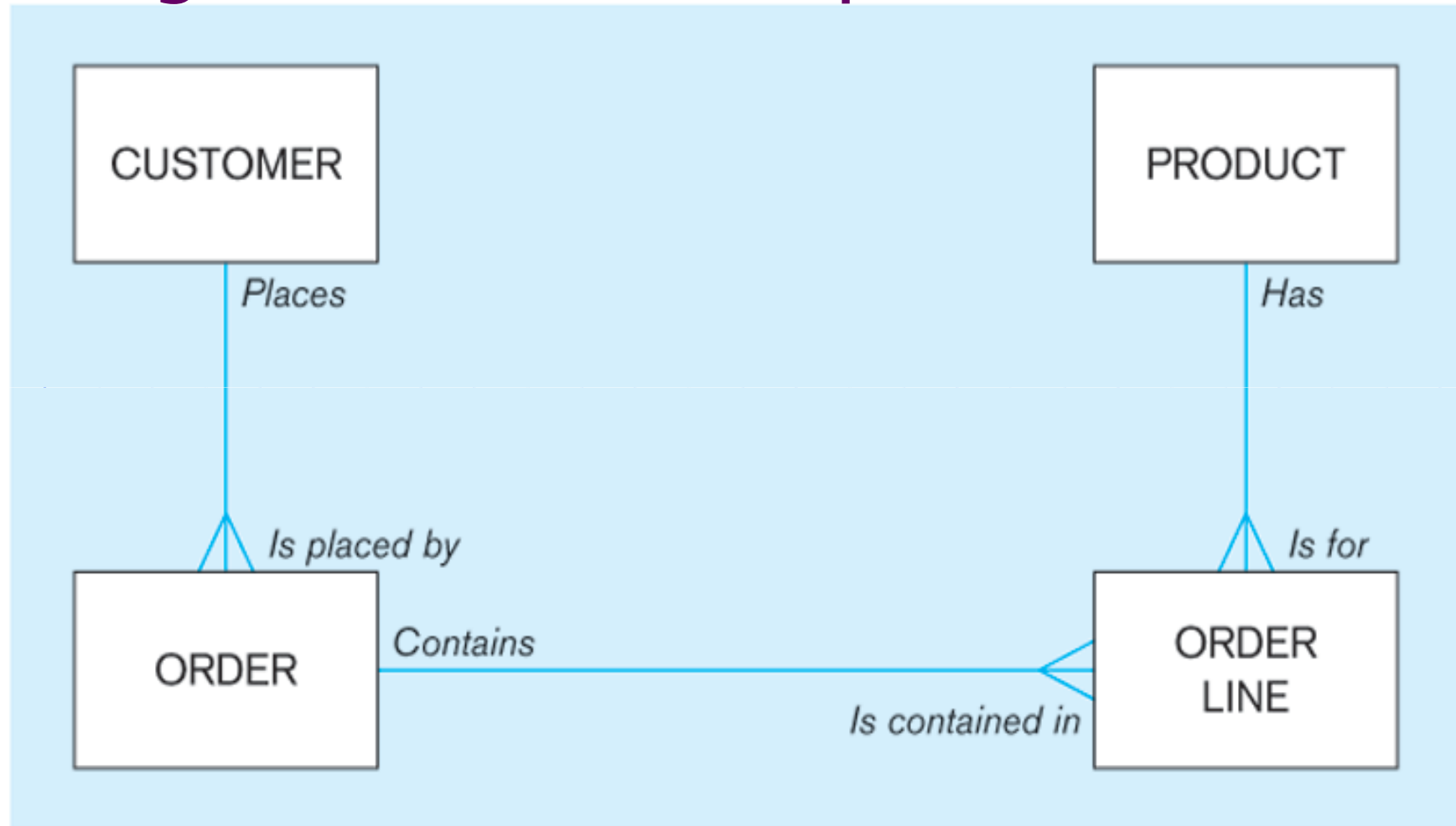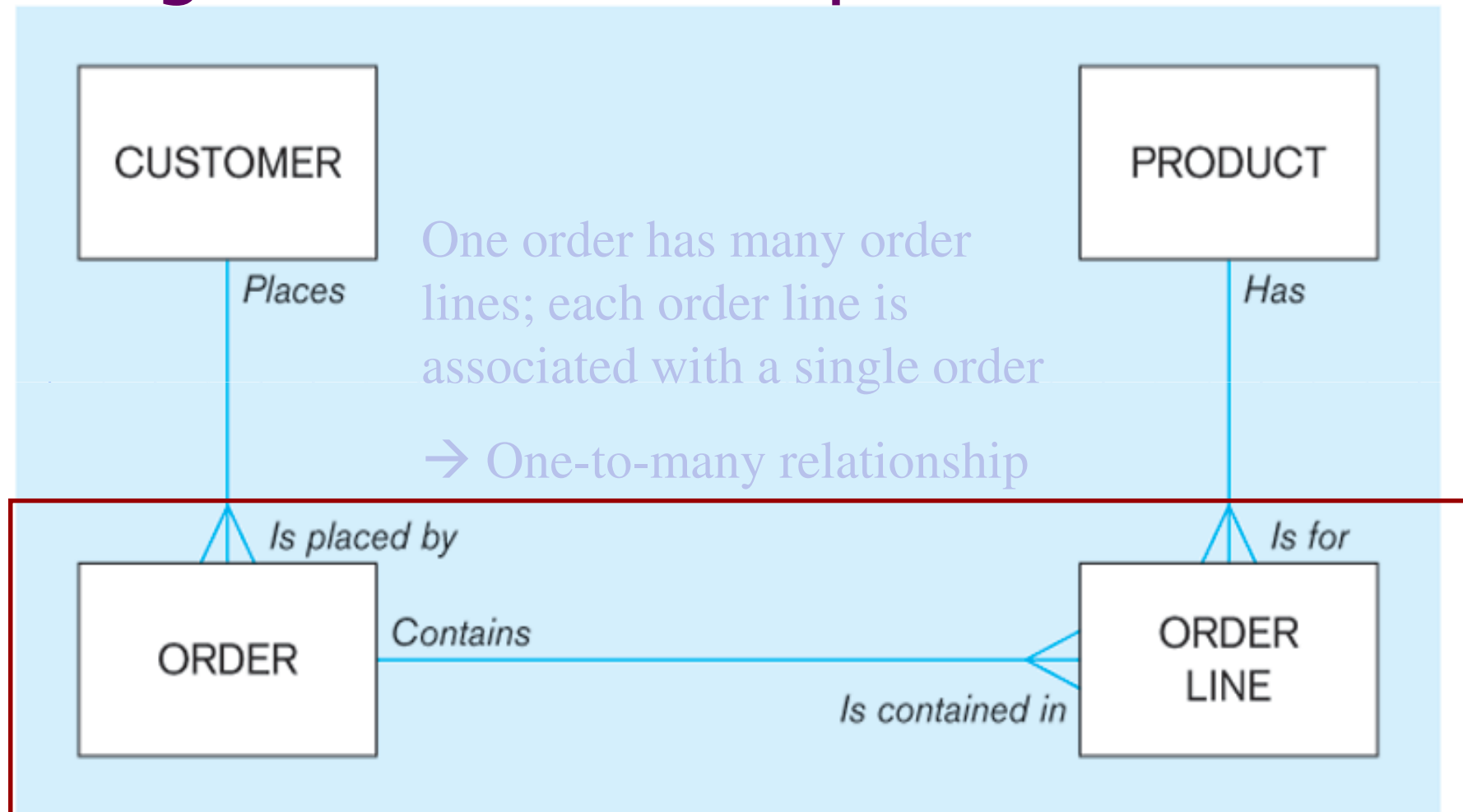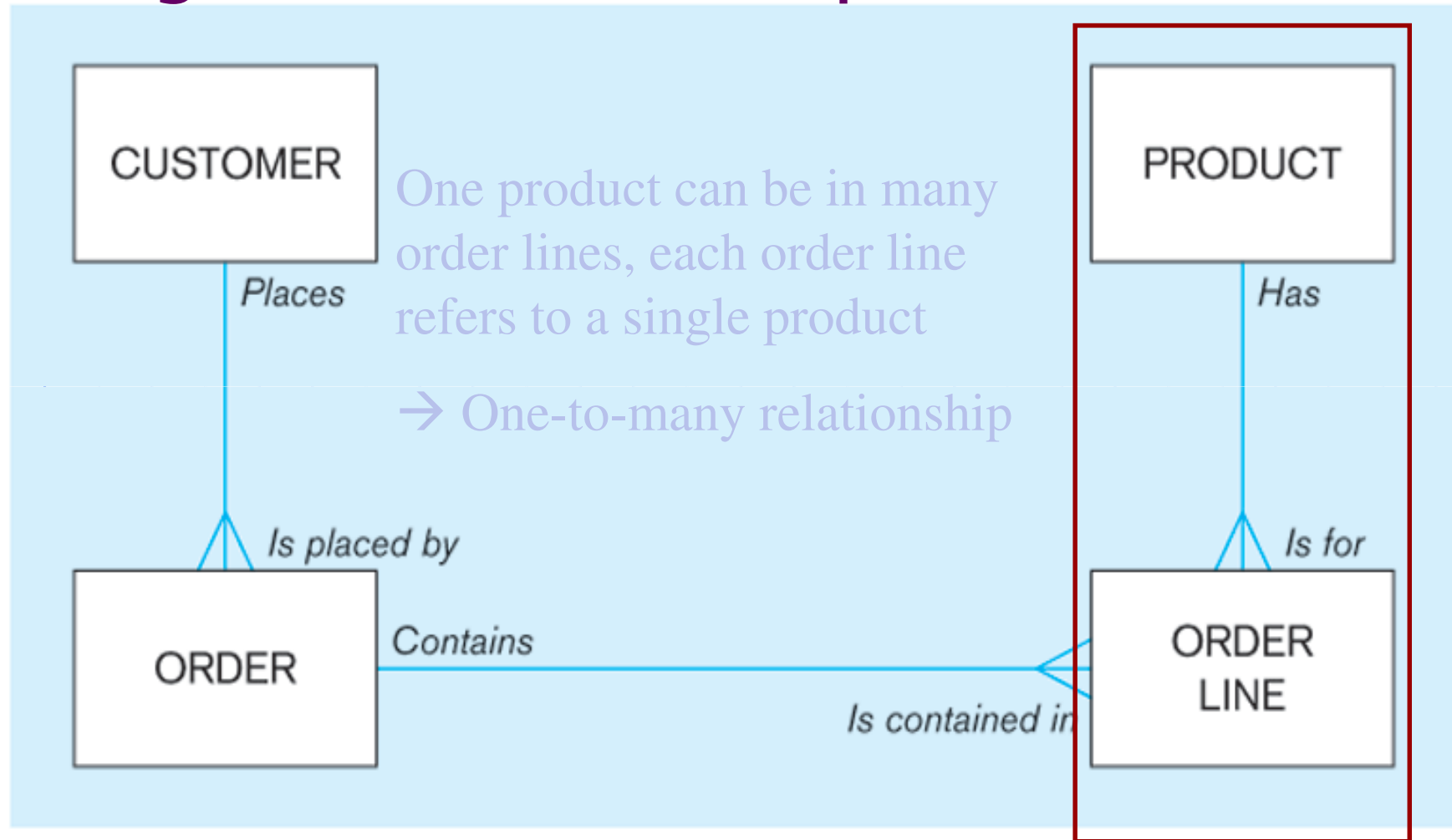
Segment of an Enterprise Data Model
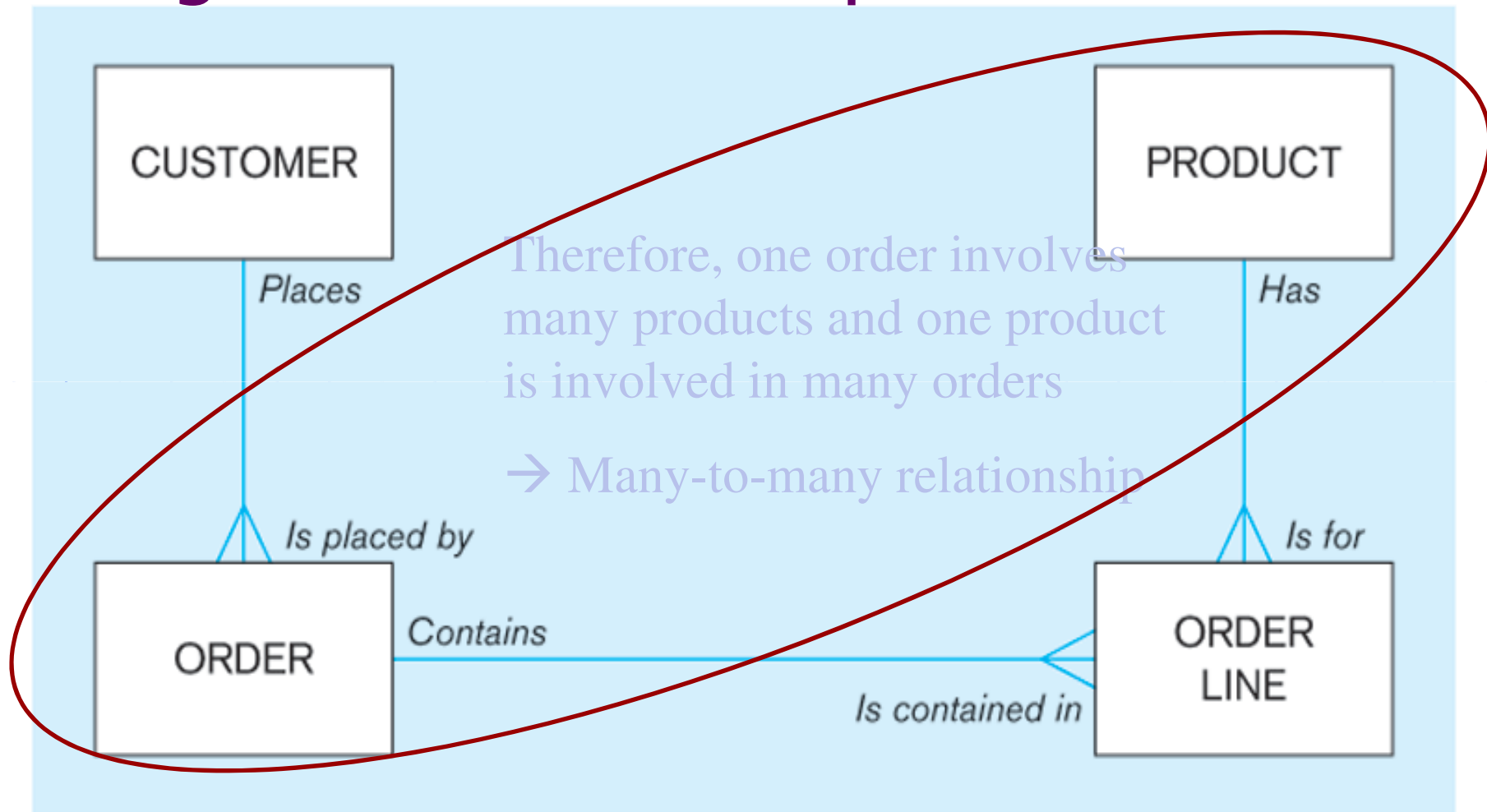
Segment of an Enterprise Data Model

One customer may place many orders, but each order is placed by a single customer

→ One-to-many relationship

Segment of an Enterprise Data Model

CUSTOMER

Places

PRODUCT

Has

One order has many order lines; each order line is associated with a single order

→ One-to-many relationship

Is placed by

Is for

ORDER

Contains

Is contained in

ORDER LINE

Segment of an Enterprise Data Model

CUSTOMER

Places

Is placed by

ORDER

Contains

Is contained in

One product can be in many
order lines, each order line
refers to a single product

→ One-to-many relationship

PRODUCT

Has

Is for

ORDER
LINE

Segment of an Enterprise Data Model

CUSTOMER

Places

Is placed by

ORDER

Contains

Is contained in

PRODUCT

Has

Is for

ORDER LINE

Therefore, one order involves many products and one product is involved in many orders

→ Many-to-many relationship

Relationships established in special columns that provide links between tables

Client/server system architecture
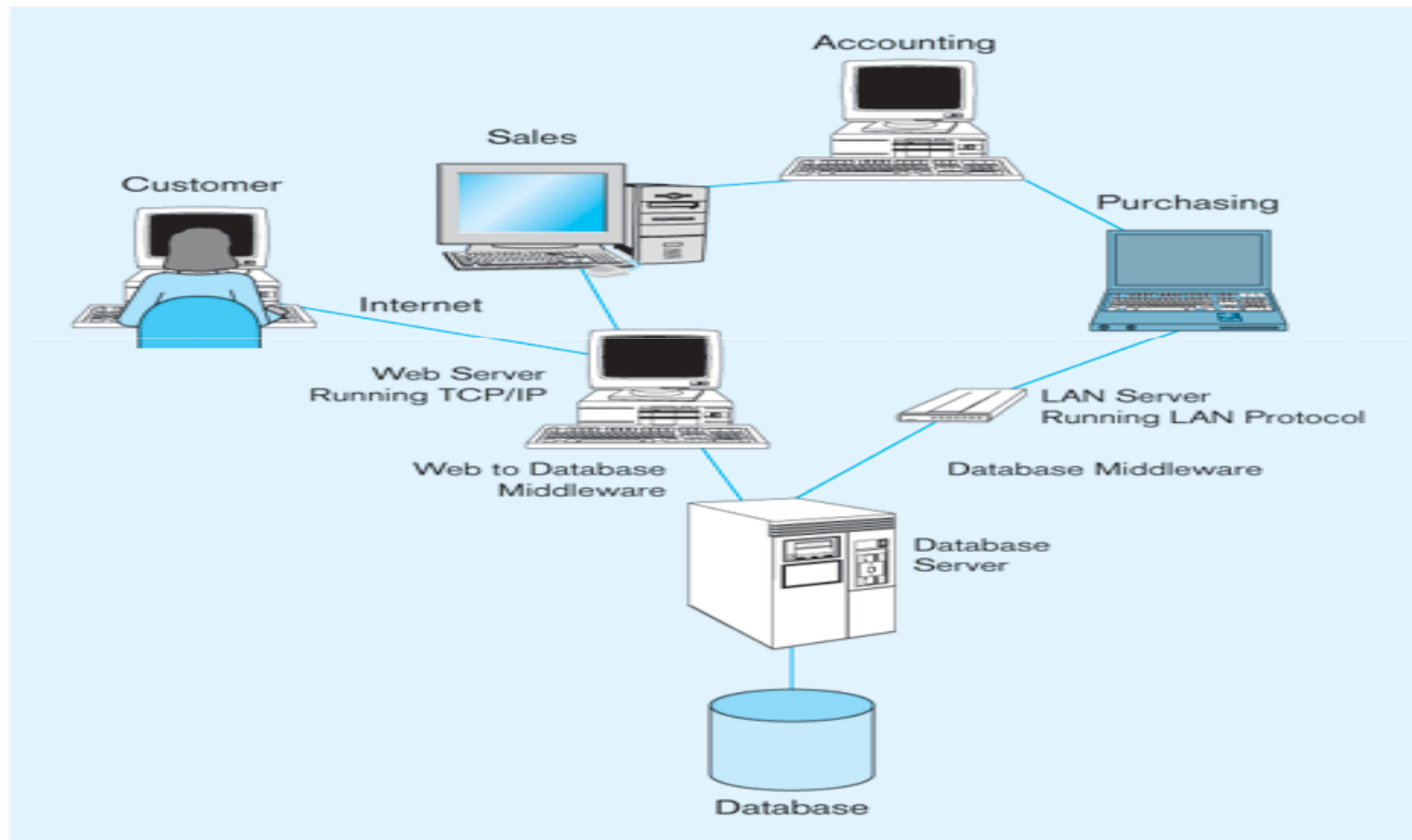
Microsoft Access - [PVFC Customer Invoice]

File   Edit   View   Tools   Window   Help   add a group footer

100%   Close   Setup

PVFC Customer Invoice

Customer ID	2	Order ID	1006
Customer Name	Value Furniture	Order Date	10/24/2004
Address	15145 S.W. 17th St.		
	Plano TX 750		

Product ID	Product Description	Finish	Quantity	Unit Price	Extended Price
7	Dining Table	Natural Ash	2	$800.00	$1,600.00
5	Writers Desk	Cherry	2	$325.00	$650.00
4	Entertainment Center	Natural Maple	1	$650.00	$650.00

Application program functions:
   inserting new data, *updating* existing data,
   deleting existing data, *reading* data for display

Ranges of DB Applications

1. Personal
2. Workgroup
3. Department
4. Enterprise
   - Legacy data
   - Data Warehouse
5. Internet, Intranet and Extranet

Sample of a Personal DB

Customer

Customer Name:
Multi Media, Inc.

Address:
1000 River Road
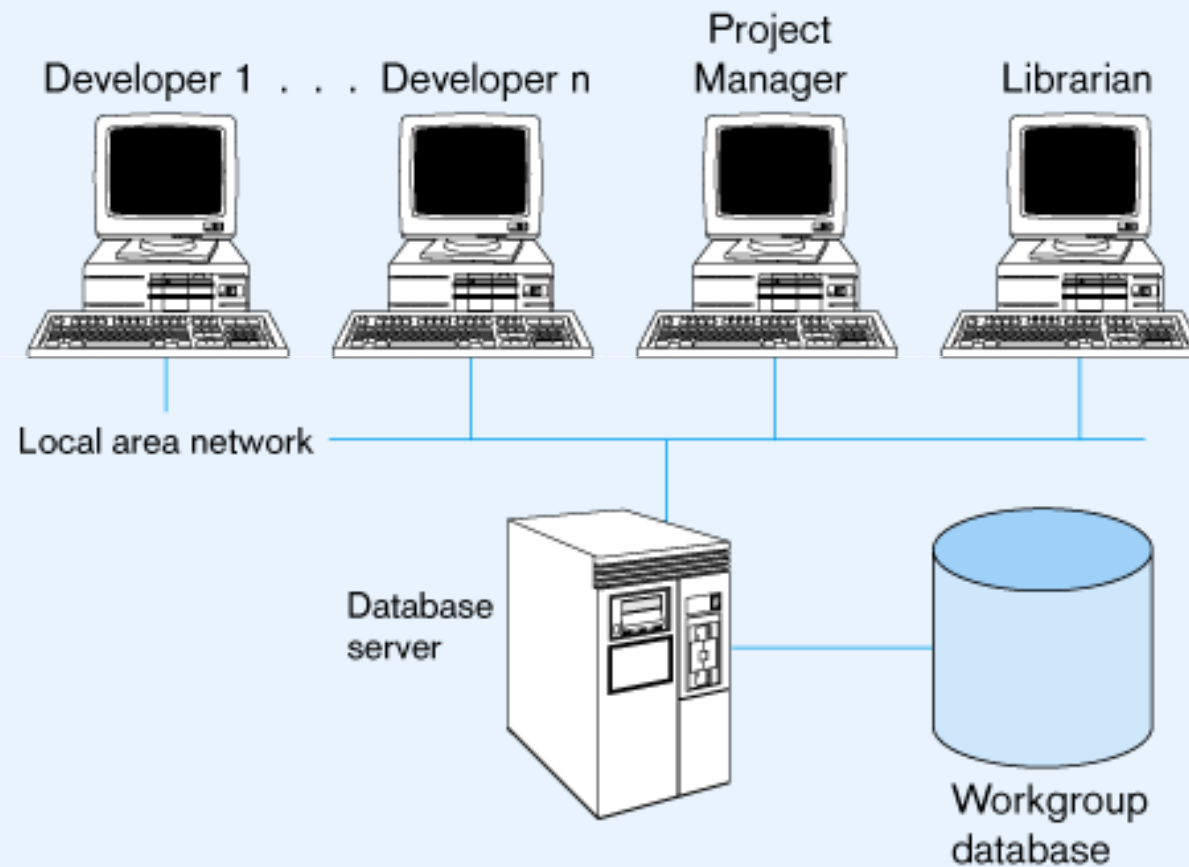
City:
San Antonio

State:
TX

Zip:
76235

Phone:
(219) 864-2000

Next Contact Date:
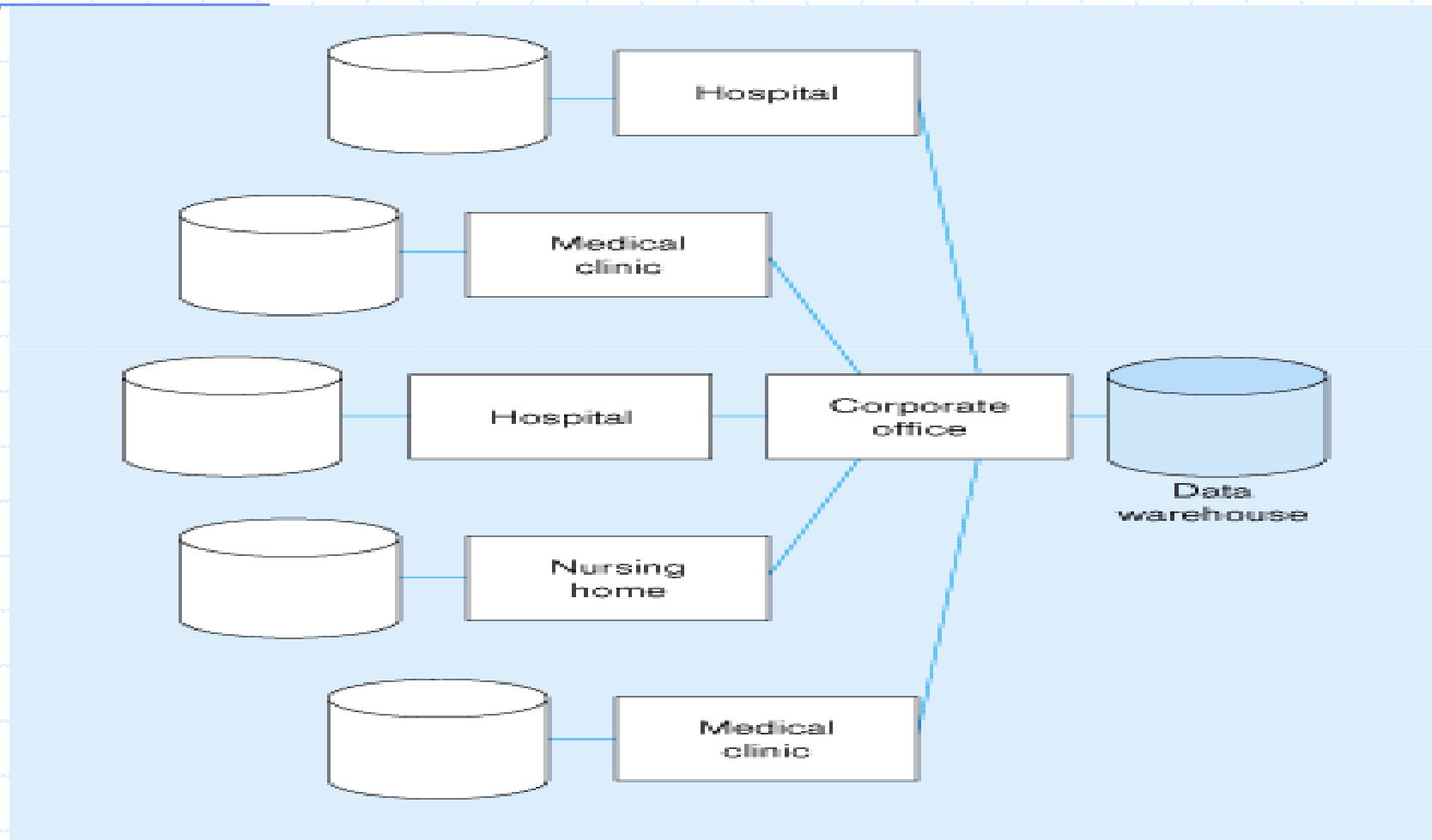**10/17/2003**

Time:
10:30 AM

Contact History for Customer

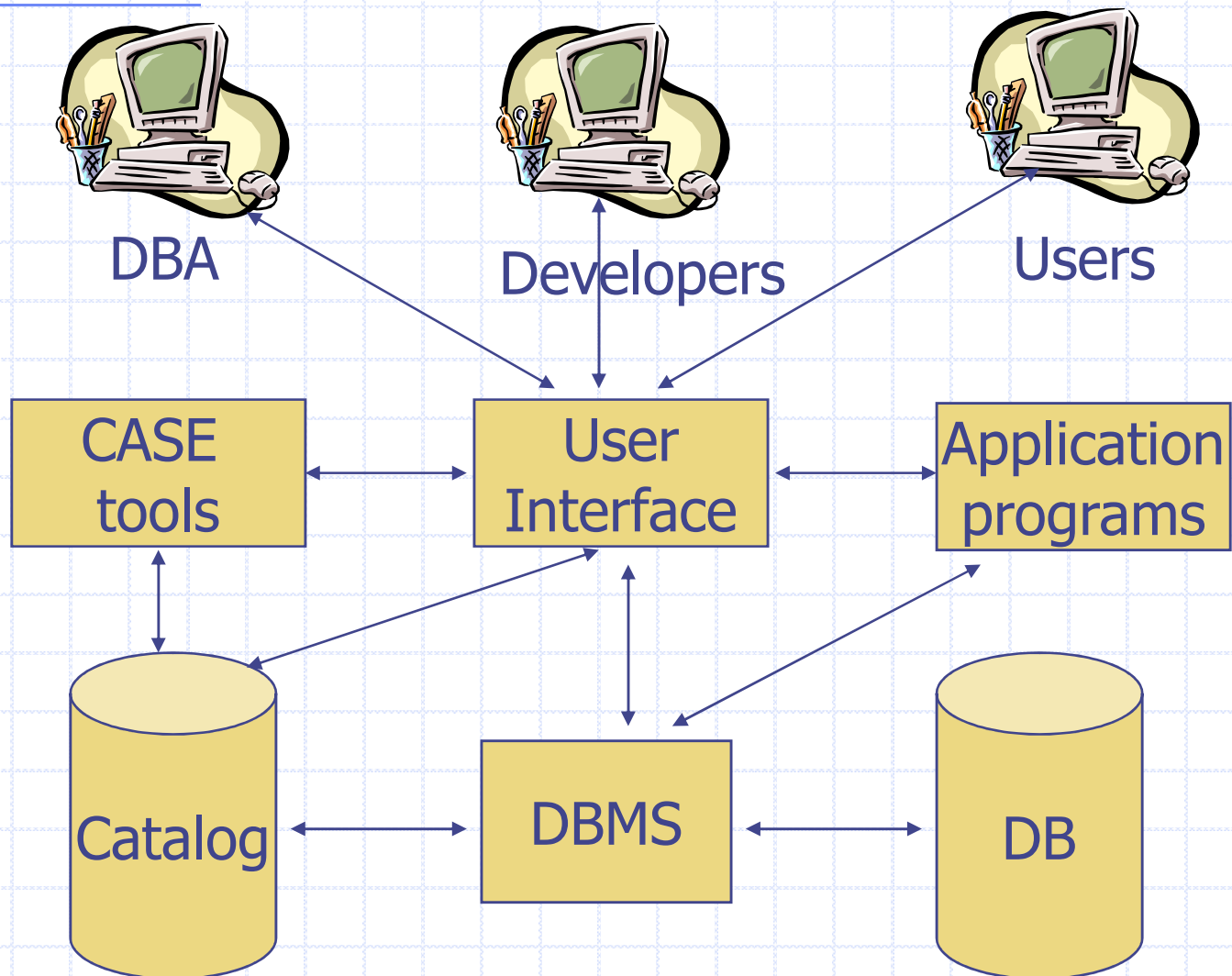| Date	Time	Contact	Comments
08/04/2003	10:00 AM	Roberts	Review proposal
08/19/2003	08:00 AM	Roberts	Revise schedule
09/10/2003	09:00 AM	Pearson	Sign contract
09/21/2003	02:00 PM	Roberts	Follow up

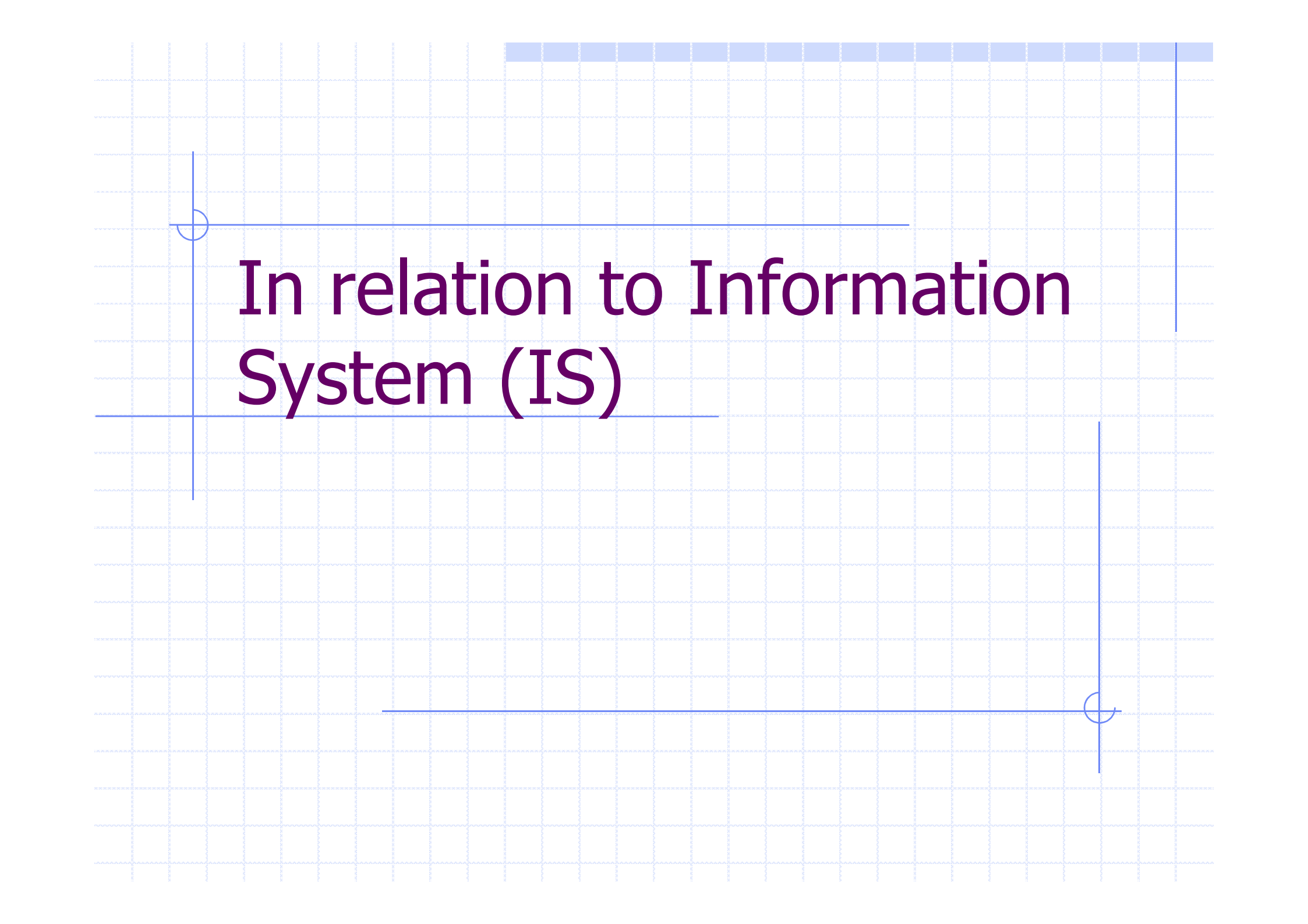# Sample of a Workgroup DB with LAN

Sample of a Enterprise DW

Components of the DB Environment

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

In relation to Information System (IS)

What is the Use of DBMS in IS?

- When a DBMS is used, IS can be changed much more easily as the organization's information requirements change.

    - (without necessarily disrupting the existing system)

    - E.g. Individual Employee Database

        - Payroll
        - HR – Work History (201 files)
        - Medical Information

What then is Business Information System?

- Made up of <u>objects</u> (customers, employees, vendors, etc.) and <u>activities</u> (orders, payments, purchases, etc.)

What then is DB Designing?

- Process of deciding how to organize the data into record types and how they will relate to each other

Assignment for next meeting

Write a paper on the evolution of Database Systems