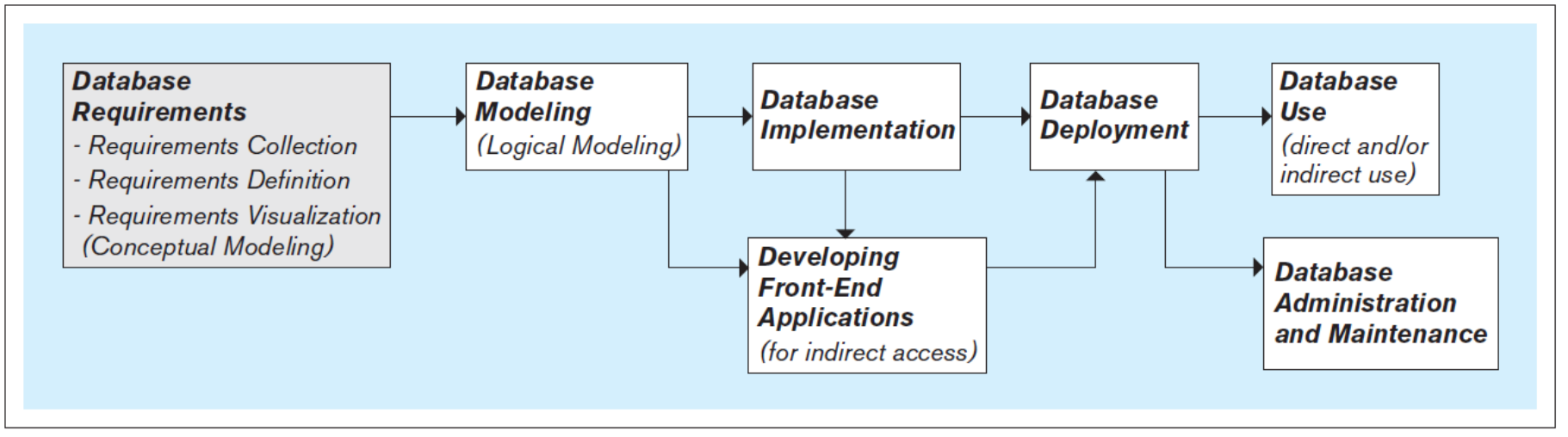
Database Systems -

Introduction to Databases and Data Warehouses

CHAPTER 1 - Introduction

STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

- Pre-development activities - planning and budgeting
- Major development activities:



STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

- **Requirements collection, definition, and visualization**
  - The first and most critical step in the development of the database
  - Results in the requirements about
    - Which data the future database system will hold and in what fashion
    - The capabilities and functionalities of the future database system
  - The **collected** requirements should be
    - Clearly **defined** and stated in a written document
    - Then **visualized**

STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

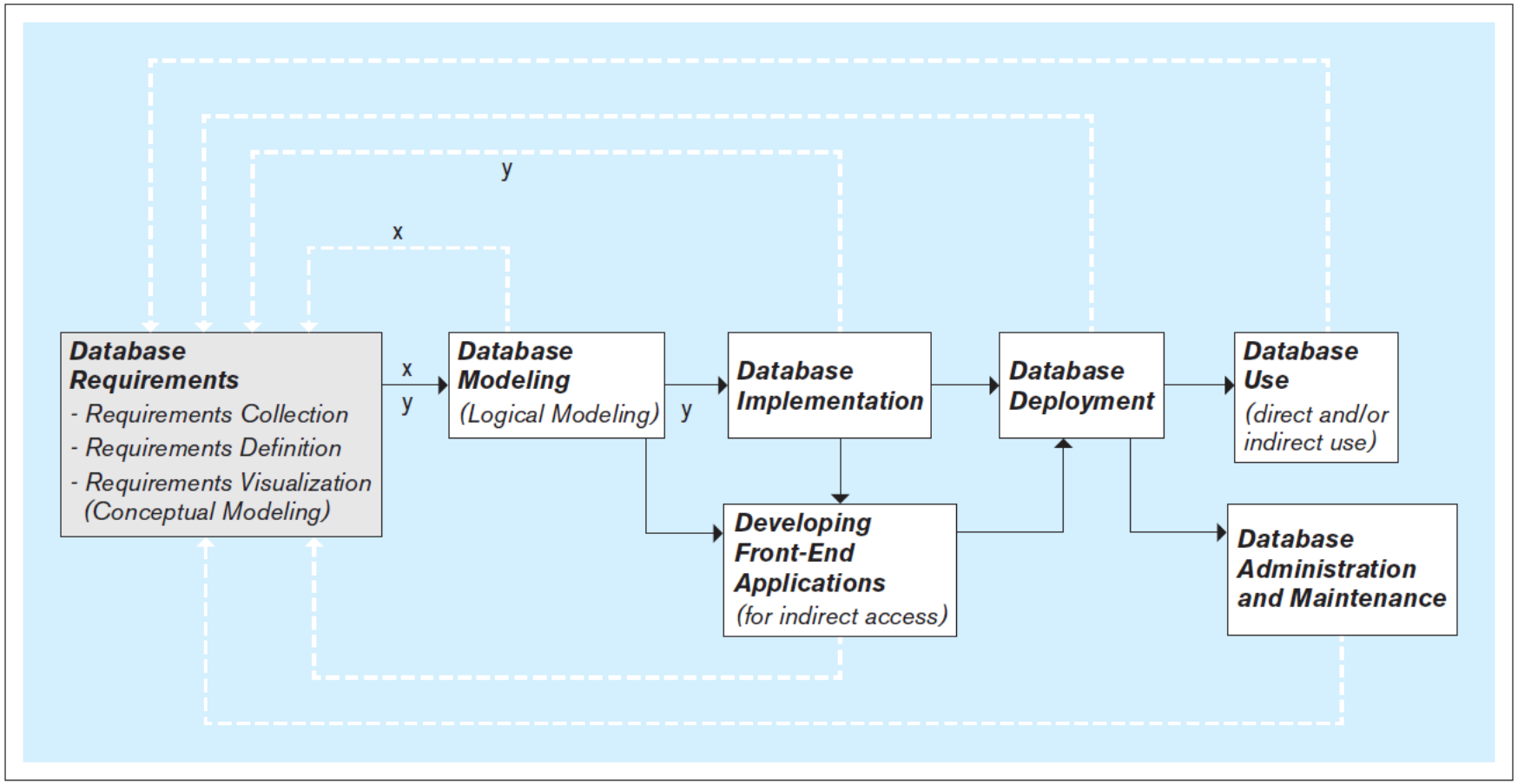
- Requirements collection, definition, and visualization
  - Conceptual database model
    - A visualization of requirements by using a conceptual data modeling technique (such as entity-relationship [ER] modeling)
      - Conceptual data modeling = requirement visualization
  - An iterative process
    - Iteration inside step 1
      - Begin with a small set of requirements
      - Discussed by database developers and intended end users
      - Gradually increase previous set of requirements

STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

- **Requirements collection, definition, and visualization**
  - An **iterative process**
    - Iteration in the whole development process
      - A requirement completed in step 1 may be changed by later steps
      - Preliminary requirement set changed by preliminary partial database model
        - x in figure
      - Requirement set is changed by database implementation step
        - Need to create an additional database construct (table or a table column)
        - y in figure

STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

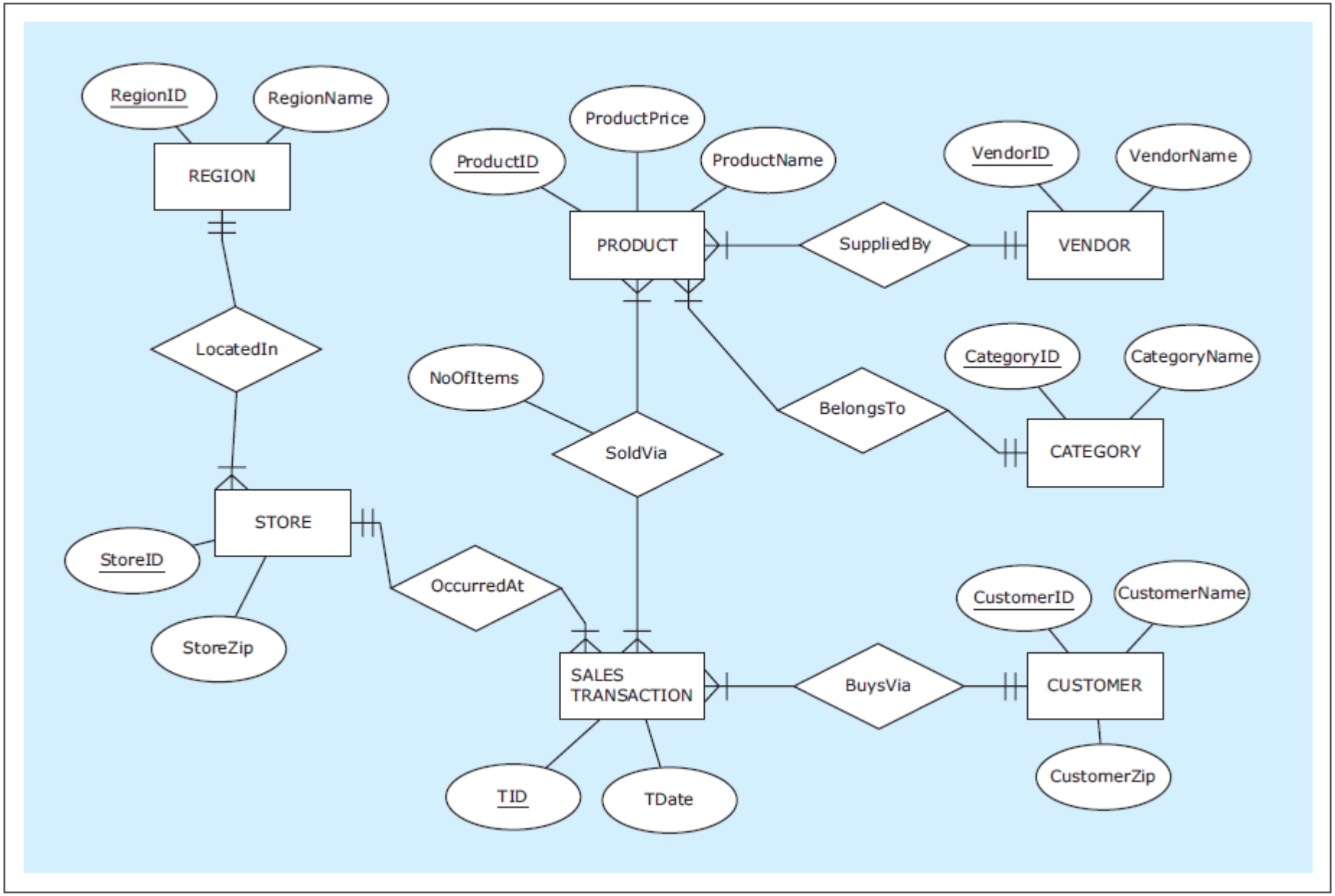
Iterative nature of the database requirements collection, definition, and visualization process



STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

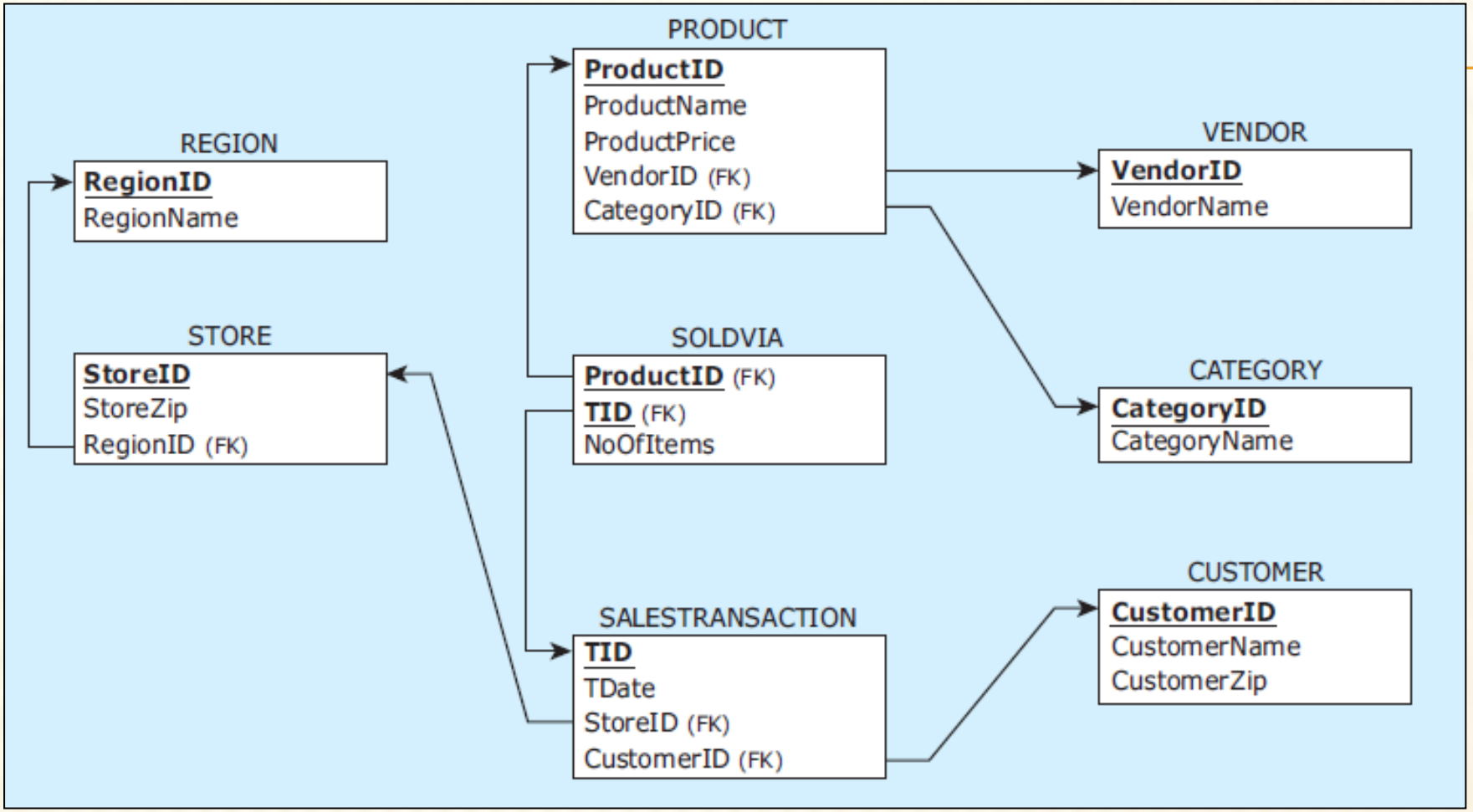
- **Database modeling (logical database modeling)**
  - Creation of the database model that is implementable by the DBMS software
  - *Logical database modeling* follows *conceptual database modeling*
  - *Most modern database modeling*
    - Map a E-R model to a relation database model
- A database has two models
  - Conceptual model
    - Created as a visualization of requirements during the requirements step
    - Serves as a as a blueprint for the actual (logical) database model
  - Logical model (implementable)
    - Actual database model
    - Created during the database modeling step
    - To be used in the subsequent step of database implementation using the DBMS

ER diagram example: ZAGI Retail Company Sales Department Database



(See notes page for details)

Example mapped relational schema: ZAGI Retail Company Sales Department Database



(See notes page for details)

STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

- **Database implementation**
  - Use a specific DBMS product to implement the database model as an actual database that is initially empty
  - Most modern databases are implemented using a relational DBMS (RDBMS) software
    - Uses SQL
  - SQL
    - A language used by most relational DBMS software packages.
    - Includes commands
      - For creating, modifying and deleting database structures
      - Used during database implementation

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
    - Based on the database model and the requirements specifying the front-end functionalities
    - Contain interfaces accessible via a navigation mechanism
      - Interfaces: forms and reports
      - Navigation: menu
    - Can be design and created in parallel with database implementation
      - Connecting front-end application to the database can only be done once the database is implemented.

STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

- **Database deployment**
  - Releasing the database system for use by the end users
  - Typically involve populating the implemented database with initial set of data

STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

- **Database use**
  - The insertion, modification, deletion and retrieval of the data in the database system
  - Used indirectly, via the front-end applications, or directly via the DBMS
  - SQL includes commands
    - For insertion, modification, deletion and retrieval of the data
    - Issued by front-end applications (indirect use), or directly by the end-users themselves (direct use)

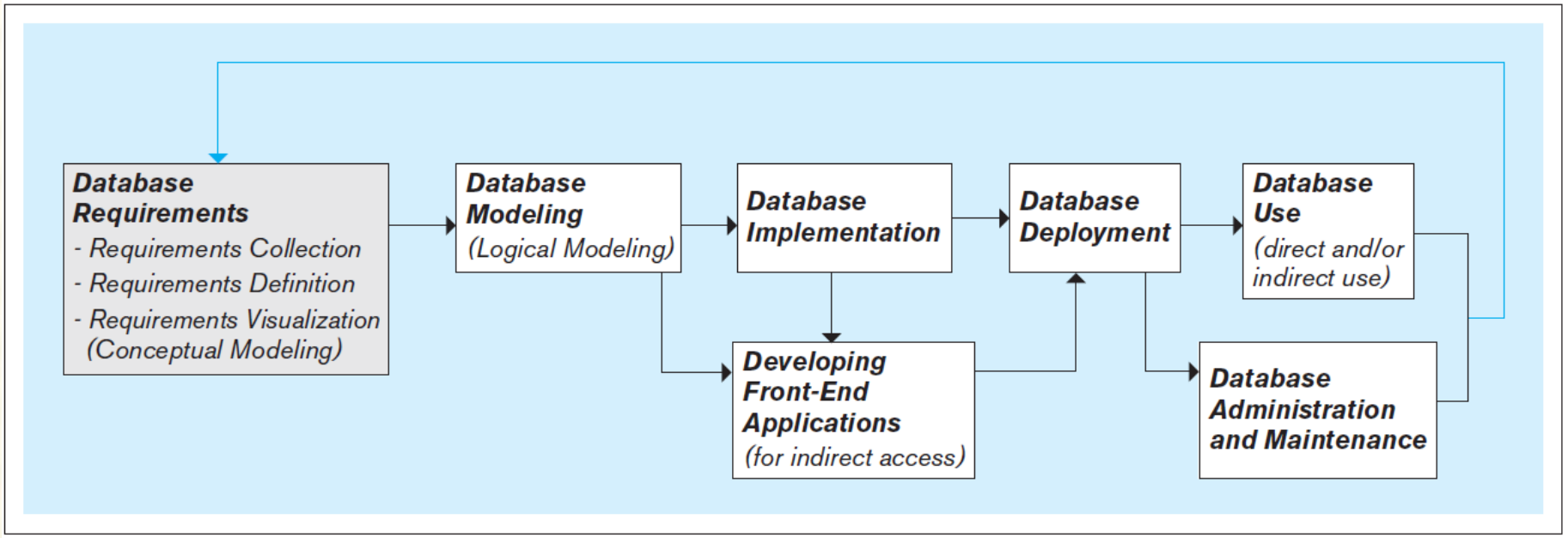
STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

- **Database administration and maintenance**
  - Performing activities that support the database end user
  - Deal with technical issues:
    - Information security
    - Sufficient hard-drive space for the database content
    - Backup and recovery procedures
    - Etc.

THE NEXT VERSION OF THE DATABASE

- The new version of the database
  - Due to the need to modify and expand existing database systems
  - Follow the same development steps as the initial version
    - Differences from initial version
      - Do not need to collect requirements from scratch
      - Change original requirements due to
        - End user observations and feedback
        - Changes in business processes

THE NEXT VERSION OF THE DATABASE



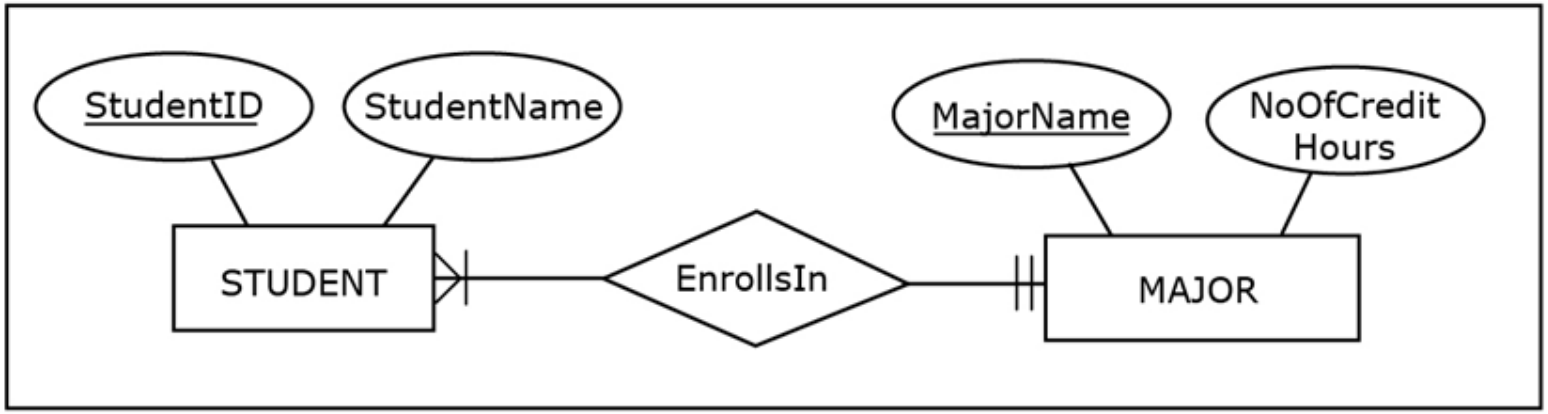
STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

- Requirements collection, definition, and visualization

Sample Requirements

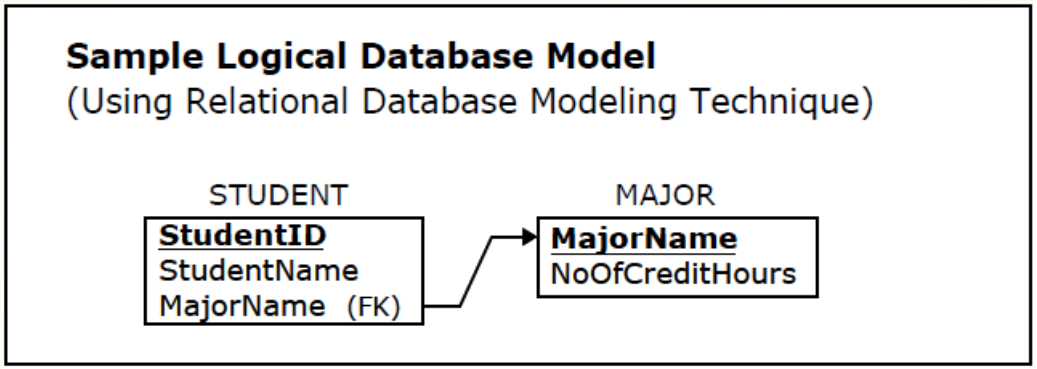
The databases will keep track of students enrolled in majors as follows:
- For each student we will keep track of a unique StudentID and a StudentName;
- For each major we will keep track of a unique MajorName and its NumberOfCreditHours;
- Each student enrolls in one major.
- Each major has one or more students enrolled in it.

Visualization of Sample Requirements as a Conceptual Model



STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

- Database modeling (logical database modeling)



STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

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

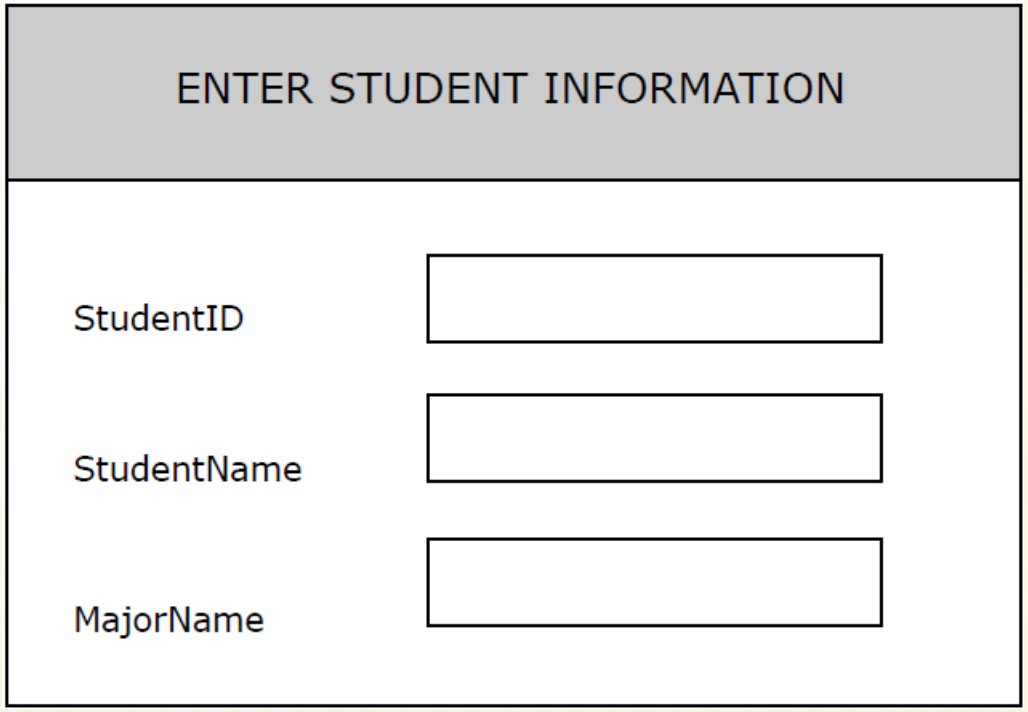
Sample SQL Code for Creating Databases

```
CREATE TABLE MAJOR
(
   MajorName CHAR(20),
   NoOfCreditHours INT,
   PRIMARY KEY (MajorName)
);

CREATE TABLE STUDENT
(
   StudentID INT,
   StudentName CHAR(10),
   MajorName CHAR(20),
   PRIMARY KEY (StudentID),
   FOREIGN KEY (MajorName) REFERENCES MAJOR(MajorName)
);
```

STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

- **Developing front-end applications** - designing and creating applications for indirect use by the end-users
  - Database front-end example



STEPS IN THE DEVELOPMENT OF DATABASE SYSTEMS

- **Database use** - the insertion, modification, deletion and retrieval of the data in the database system
  - Example of data in a database that can be inserted, modified, deleted or retrieved

MAJOR

MajorName	**NoOfCreditHours**
Accounting	152
IS	138
Marketing	138

STUDENT

StudentID	**StudentName**	**MajorName**
111	Kirsten	Marketing
222	Eve	Accounting
333	Zoe	IS
444	Courtney	Marketing
555	Ben	Accounting
666	Finola	IS
777	Iris	Marketing