

Database Management Systems

Sumayyea Salahuddin (Lecturer)
Dept. of Computer Systems Eng.
UET Peshawar

Overview

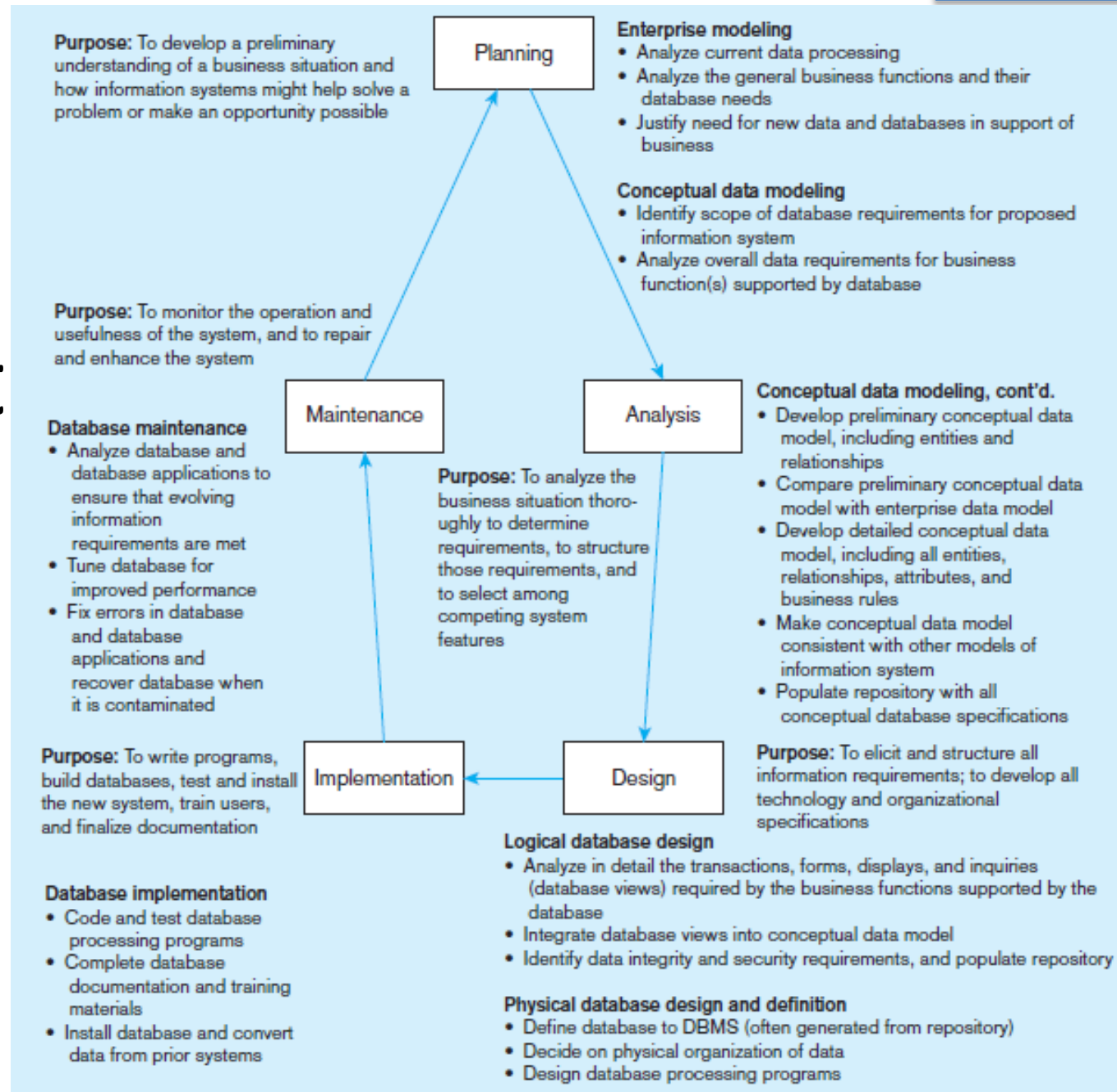
- Data Models
 - Types of Data Models
 - ❑ Enterprise, Conceptual, Logical, & Physical
 - Types of Database Design
 - ❑ Logical Database Design
 - ❑ Physical Database Design
 - System Development Life Cycle (SDLC)
 - Prototyping
 - The Database Life Cycle (DBLC)
 - Case Study: Pine Valley Furniture Company

Figure 1-10: Database Development Activities

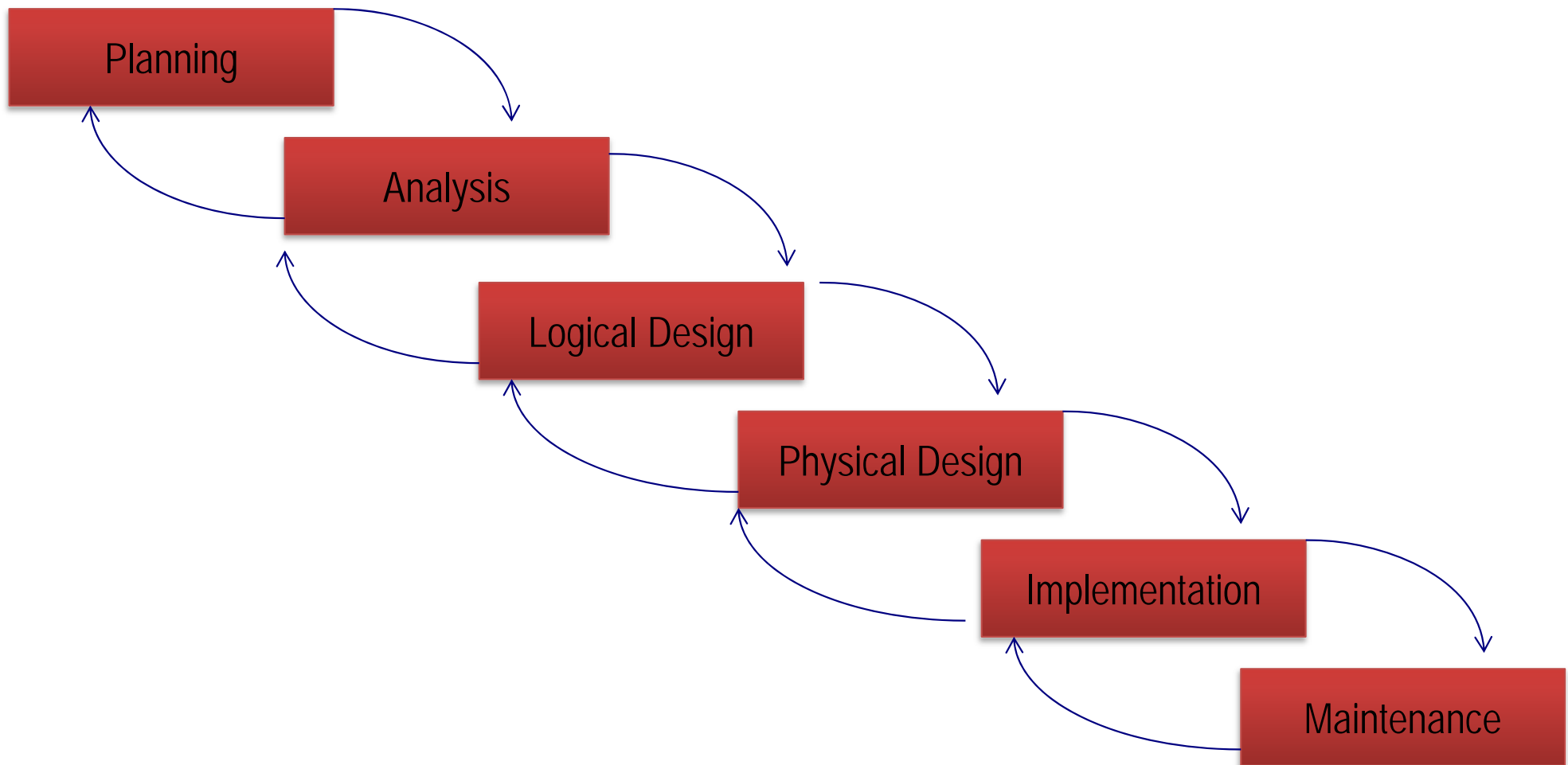
System Development Life Cycle (SDLC)

Systems development life cycle (SDLC)

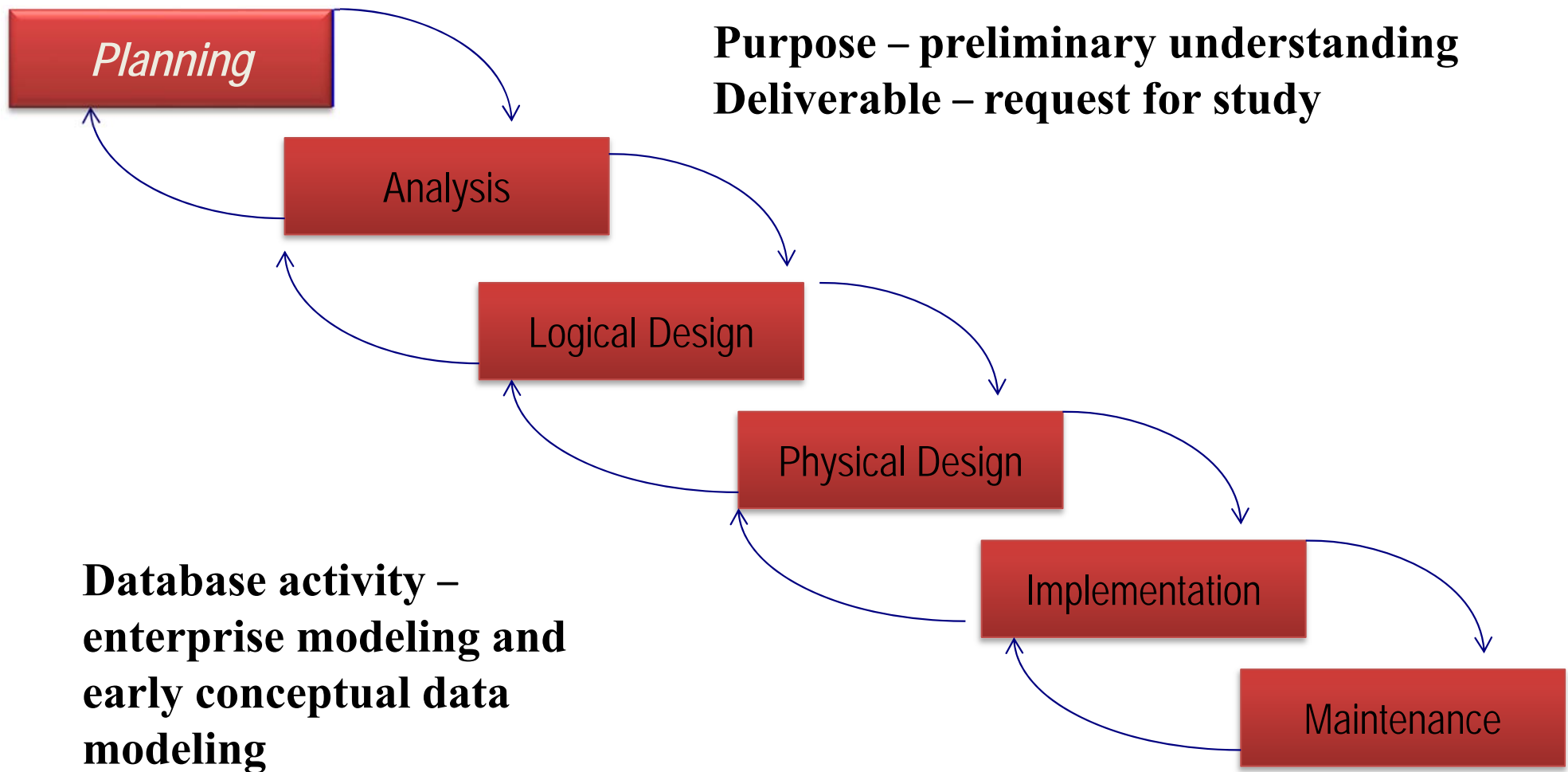
The traditional methodology used to develop, maintain, and replace information systems.



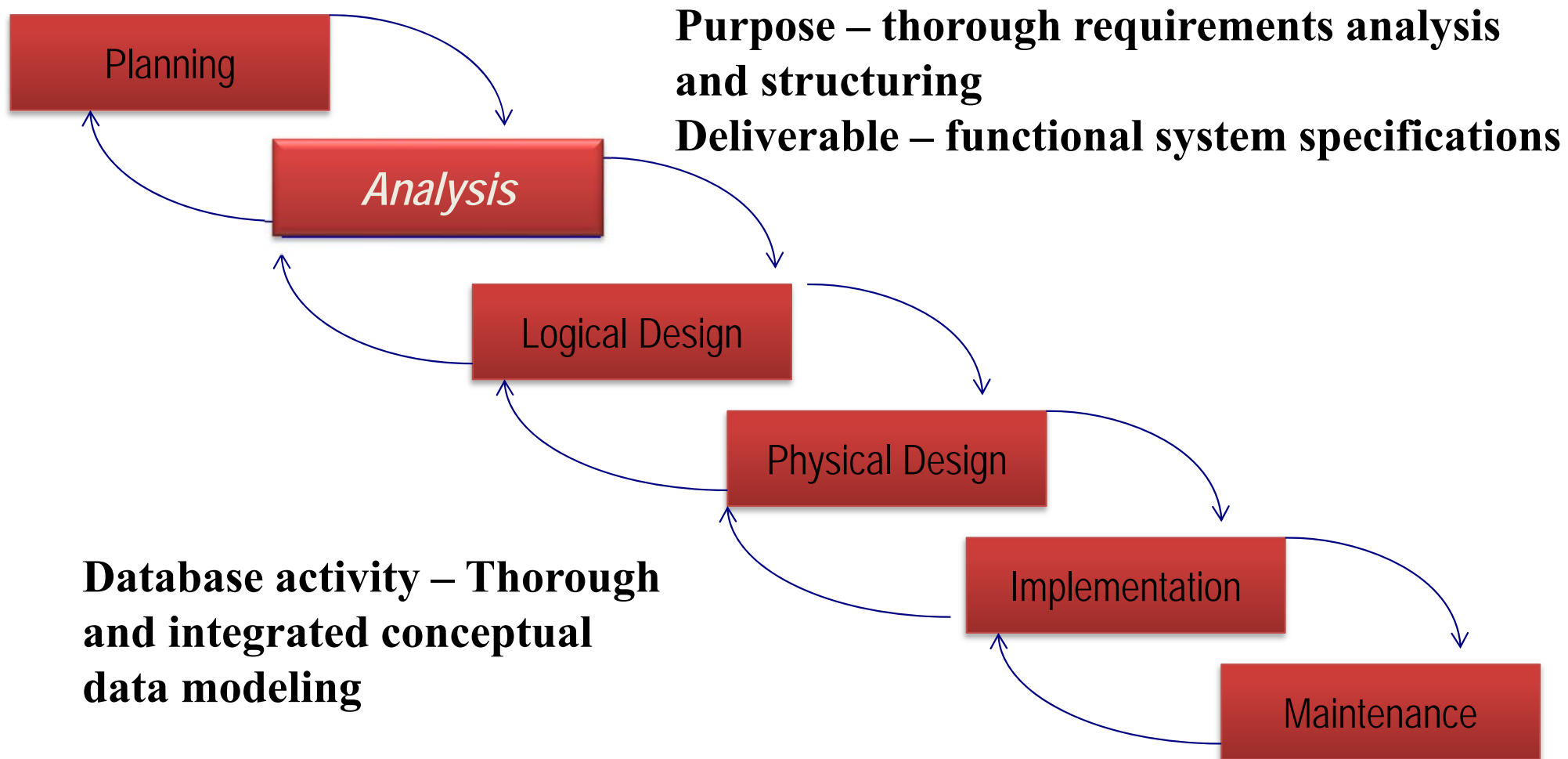
System Development Life Cycle (SDLC)



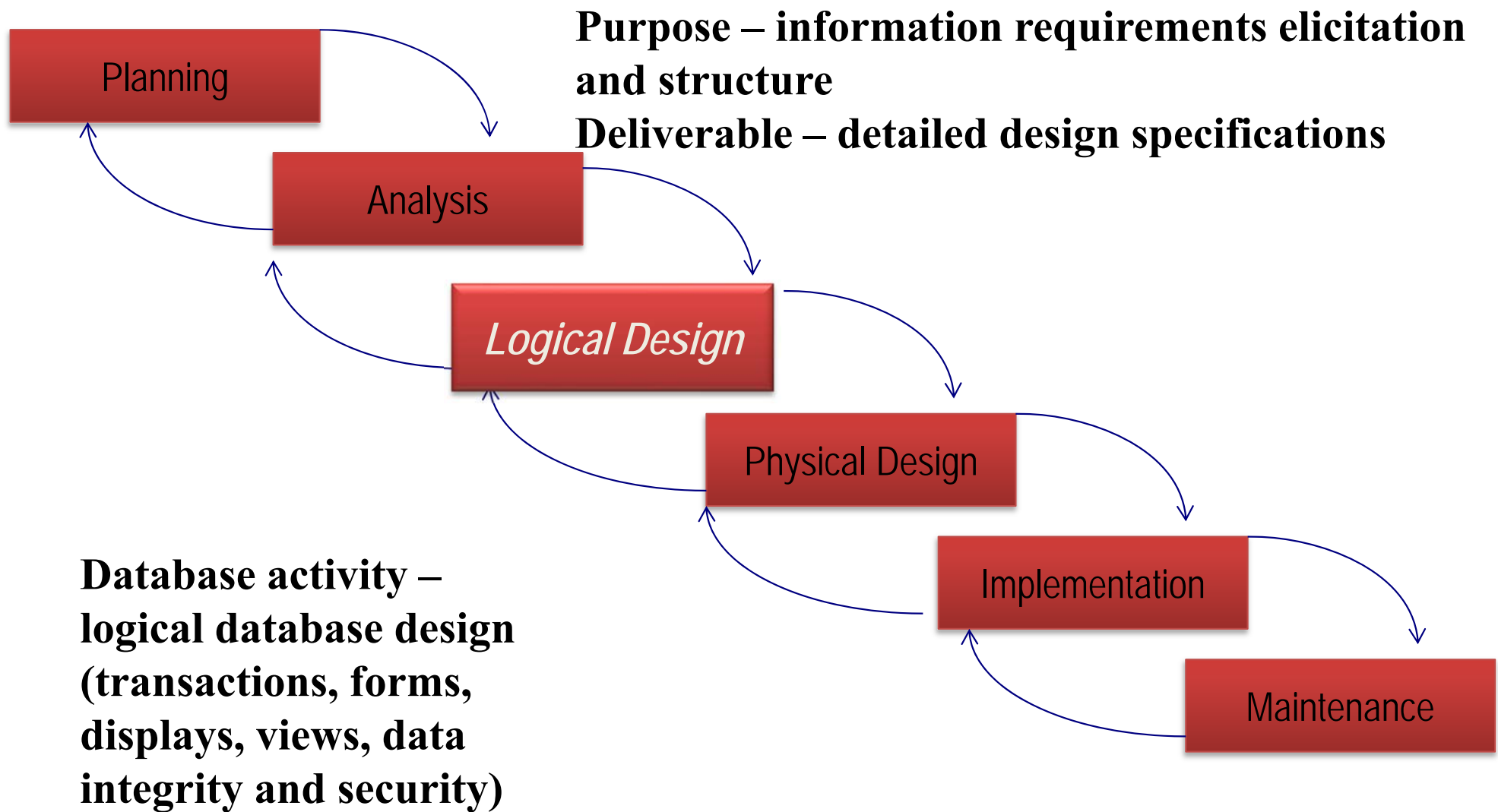
System Development Life Cycle (SDLC)



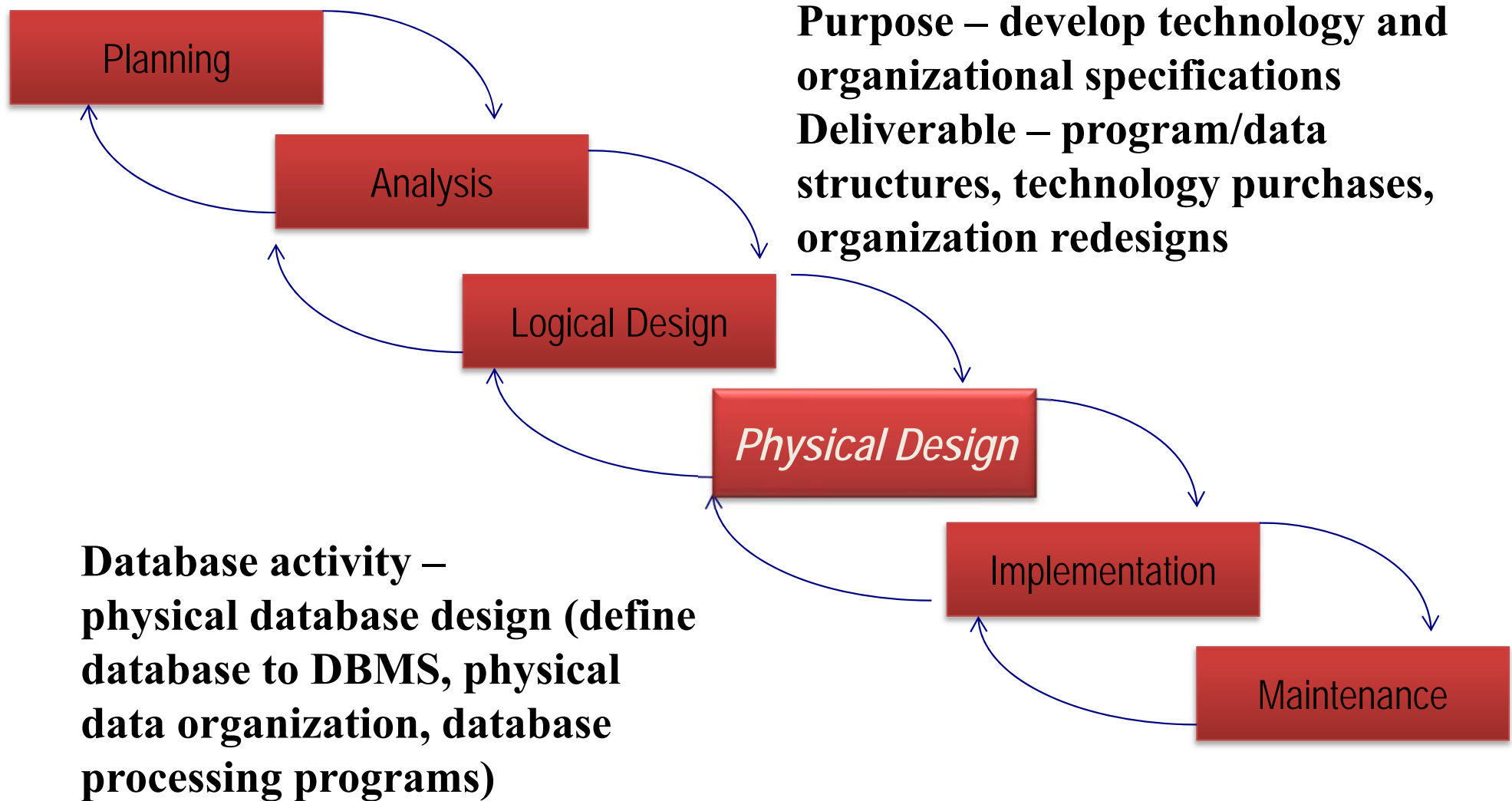
System Development Life Cycle (SDLC)



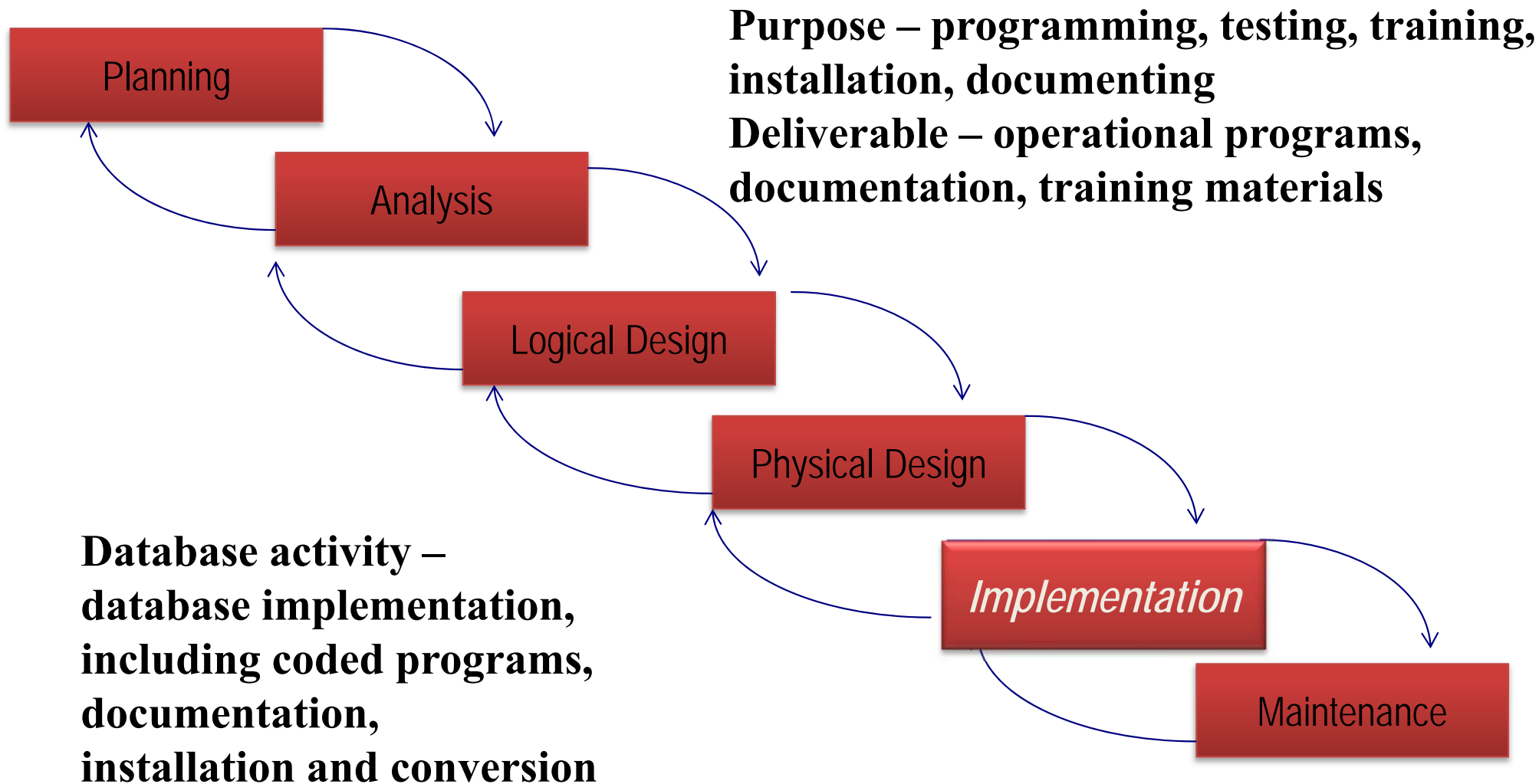
System Development Life Cycle (SDLC)



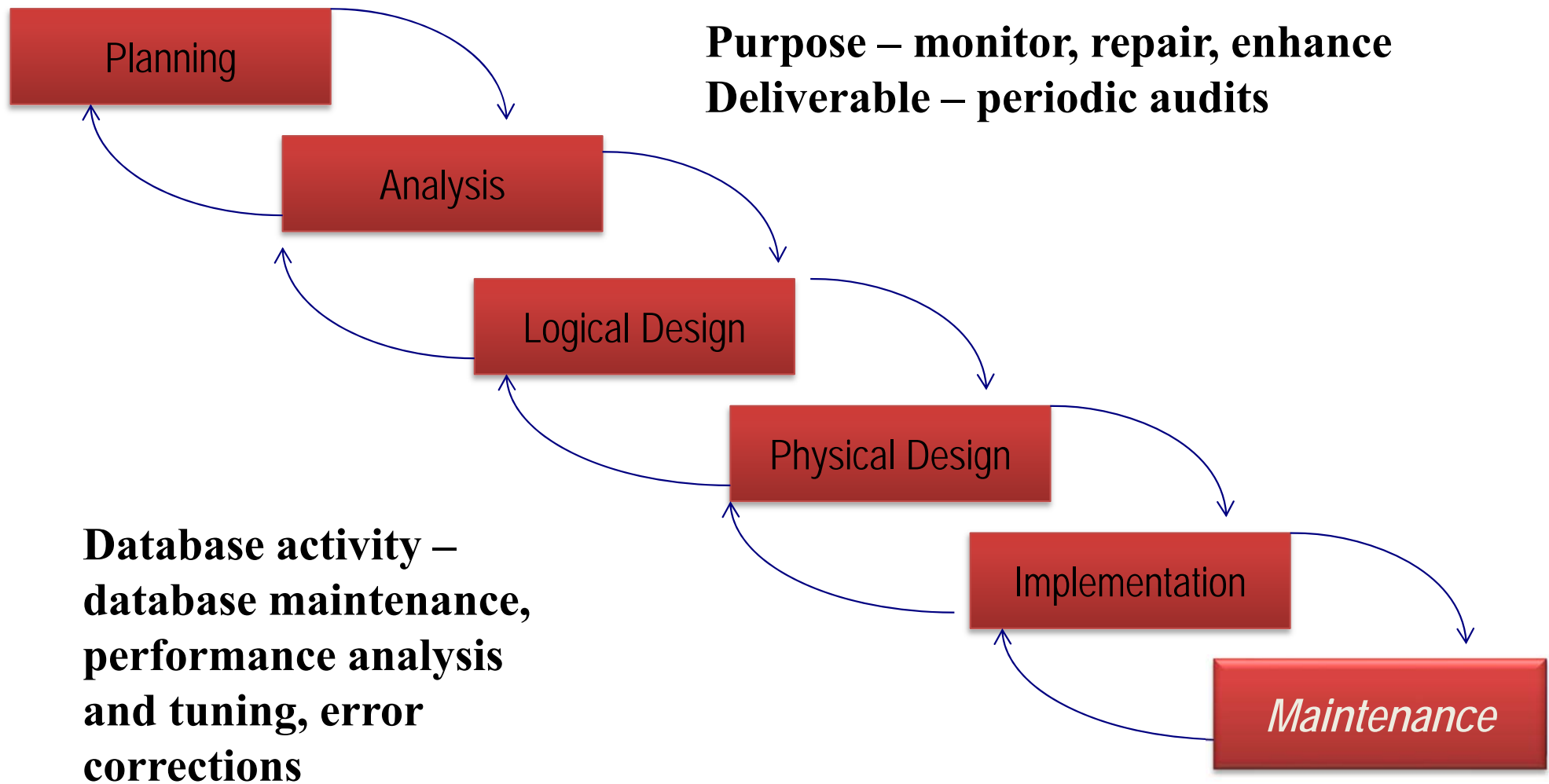
System Development Life Cycle (SDLC)



System Development Life Cycle (SDLC)



System Development Life Cycle (SDLC)



Prototyping

Prototyping

An iterative process of systems development in which requirements are converted to a working system that is continually revised through close work between analysts and users.

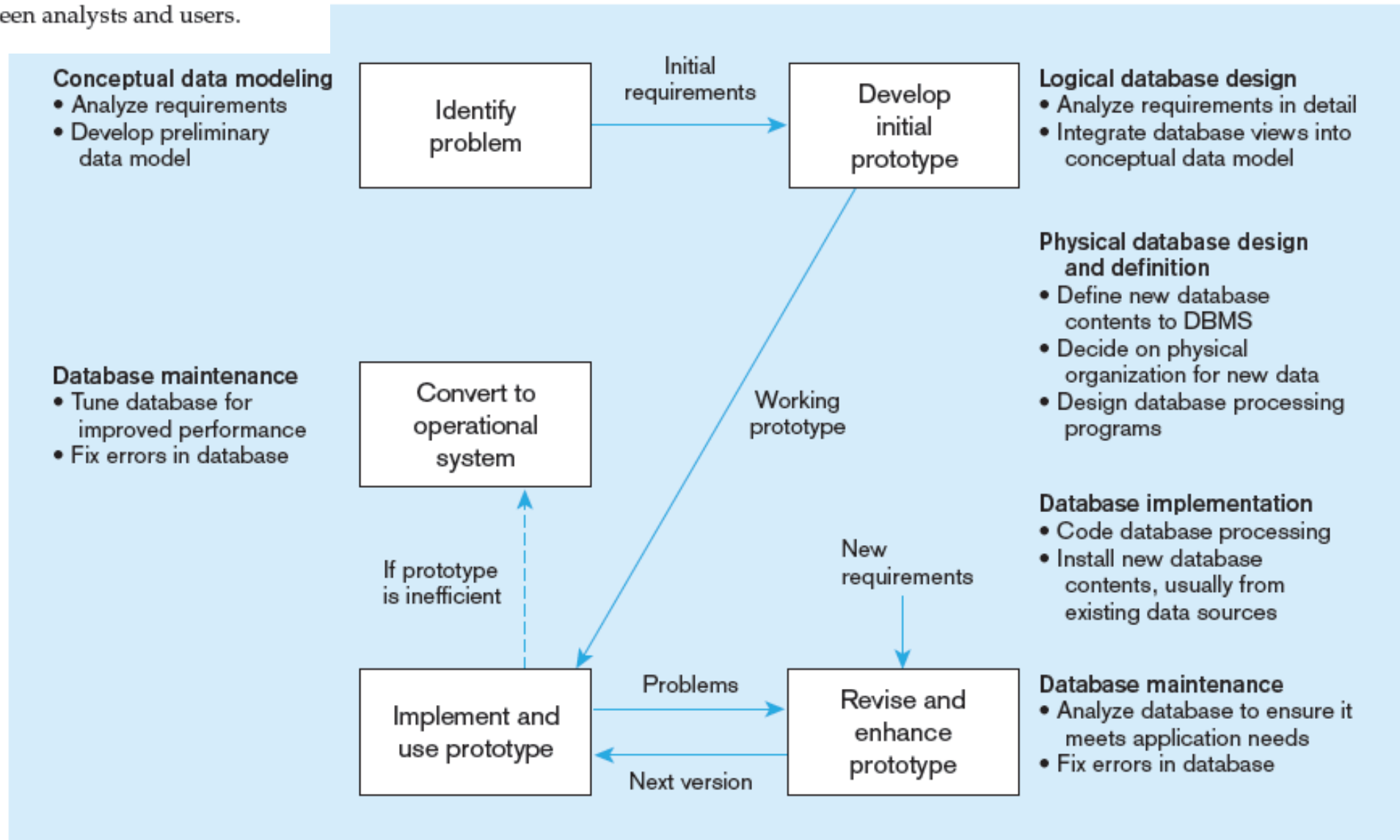


Figure 1-11: Prototyping methodology and Database Development Process

Summary of Data Models and SDLC Phases

- Enterprise data model (during the Information Systems Planning phase)
- External schema or user view (during the Analysis and Logical Design phases)
- Conceptual schema (during the Analysis phase)
- Logical schema (during the Logical Design phase)
- Physical schema (during the Physical Design phase)

Three-Schema Architecture for Database Development

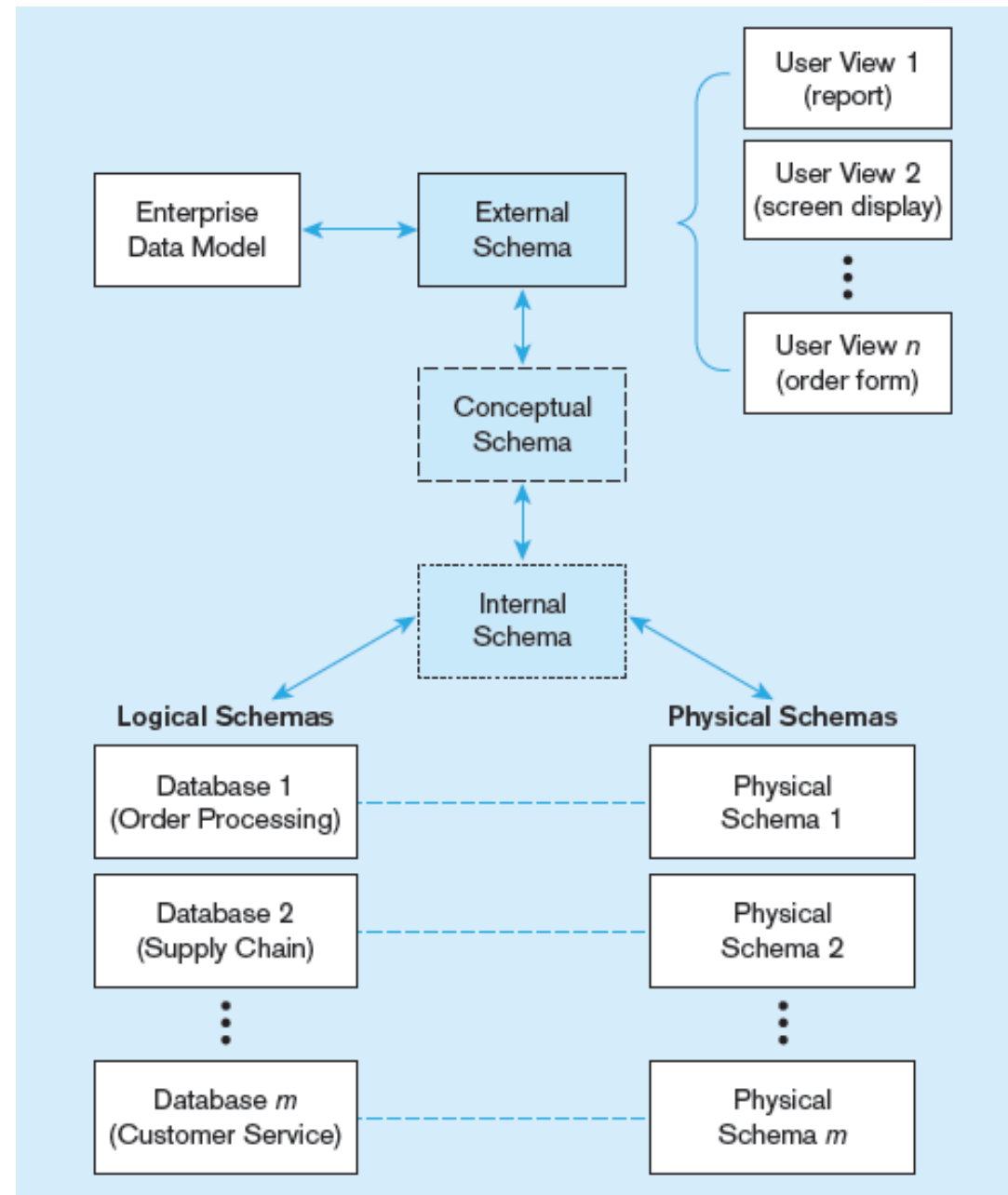


Figure 1-12: Three-Schema Architecture

Three-Schema Architecture for Database Development (Cont.)

- External schema: This is the view (or views) of managers and other employees who are the **database users**. Being represented as a combination of the **enterprise data model** (a top-down view) and a collection of detailed (or bottom-up) **user views**.
- Conceptual schema: This schema combines the **different external views** into a single, coherent, and comprehensive definition of the enterprise's data. It represents the view of the **data architect** or **data administrator**.
- Internal schema: This schema today really consists of two separate schemas: a **logical schema** and a **physical schema**. The logical schema is the representation of data for a type of data management technology (e.g., relational). The physical schema describes how data are to be represented and stored in secondary storage using a particular DBMS (e.g., Oracle).

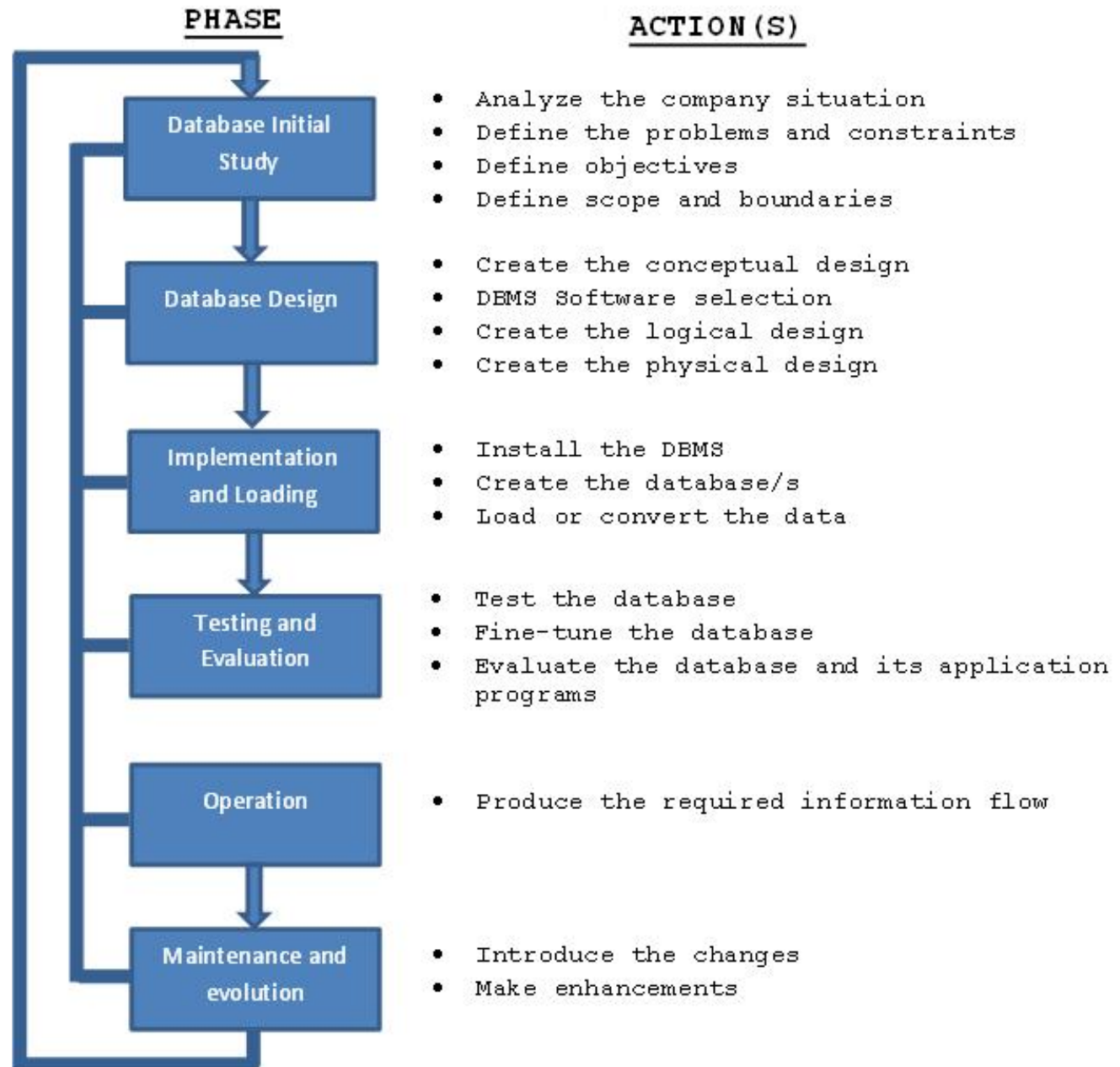
Project & People Involved

Project

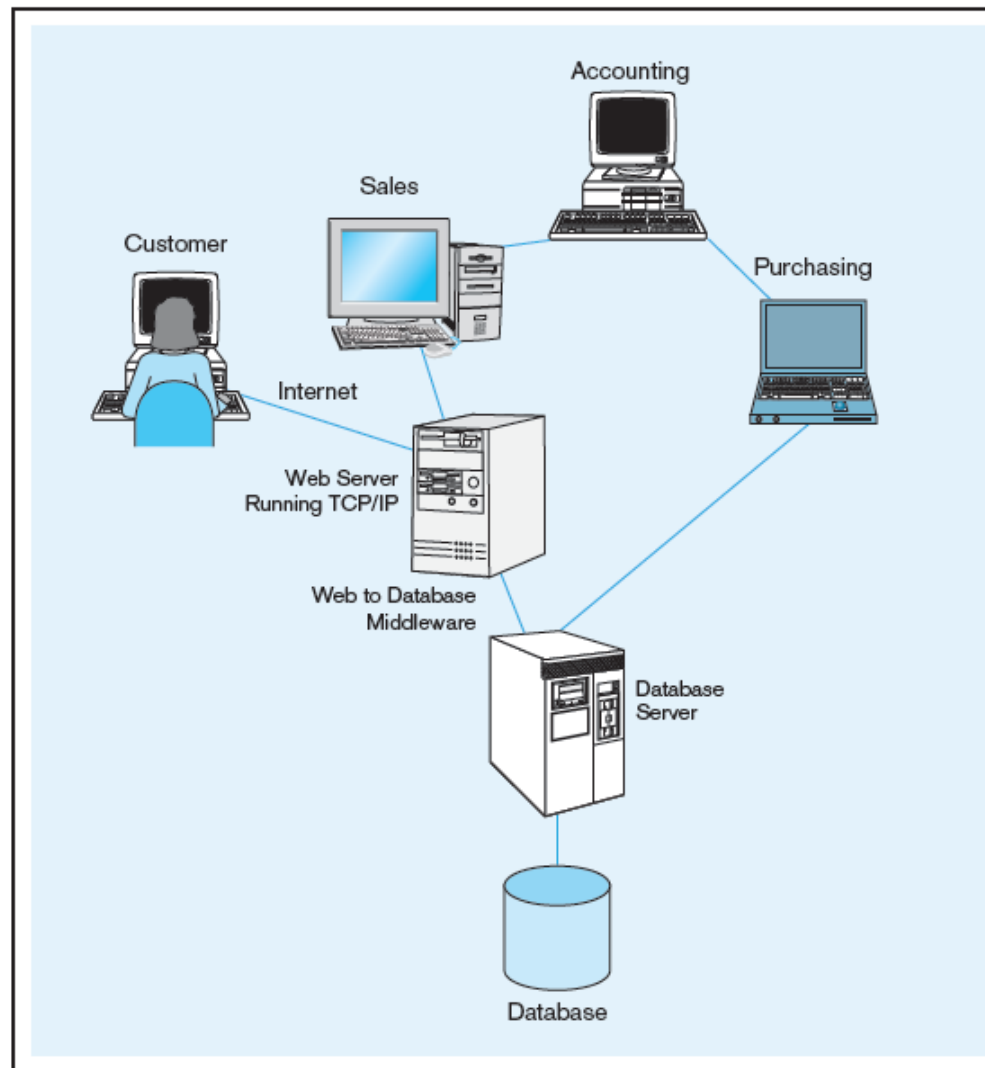
A planned undertaking of related activities to reach an objective that has a beginning and an end.

- *Business analysts* These individuals work with both management and users to analyze the business situation and develop detailed system and program specifications for projects.
- *Systems analysts* These individuals may perform business analyst activities but also specify computer systems requirements and typically have a stronger systems development background than business analysts.
- *Database analysts and data modelers* These individuals concentrate on determining the requirements and design for the database component of the information system.
- *Users* Users provide assessments of their information needs and monitor that the developed system meets their needs.
- *Programmers* These individuals design and write computer programs that have commands to maintain and access data in the database embedded in them.
- *Database architects* These individuals establish standards for data in business units, striving to attain optimum data location, currency, and quality.
- *Data administrators* These individuals have responsibility for existing and future databases and ensure consistency and integrity across databases, and as experts on database technology, provide consulting and training to other project team members.
- *Project managers* Project managers oversee assigned projects, including team composition, analysis, design, implementation, and support of projects.
- *Other technical experts* Other individuals are needed in areas such as networking, operating systems, testing, data warehousing, and documentation.

The Database Life Cycle (DBLC)



Client/Server System



Entities & Business Rules

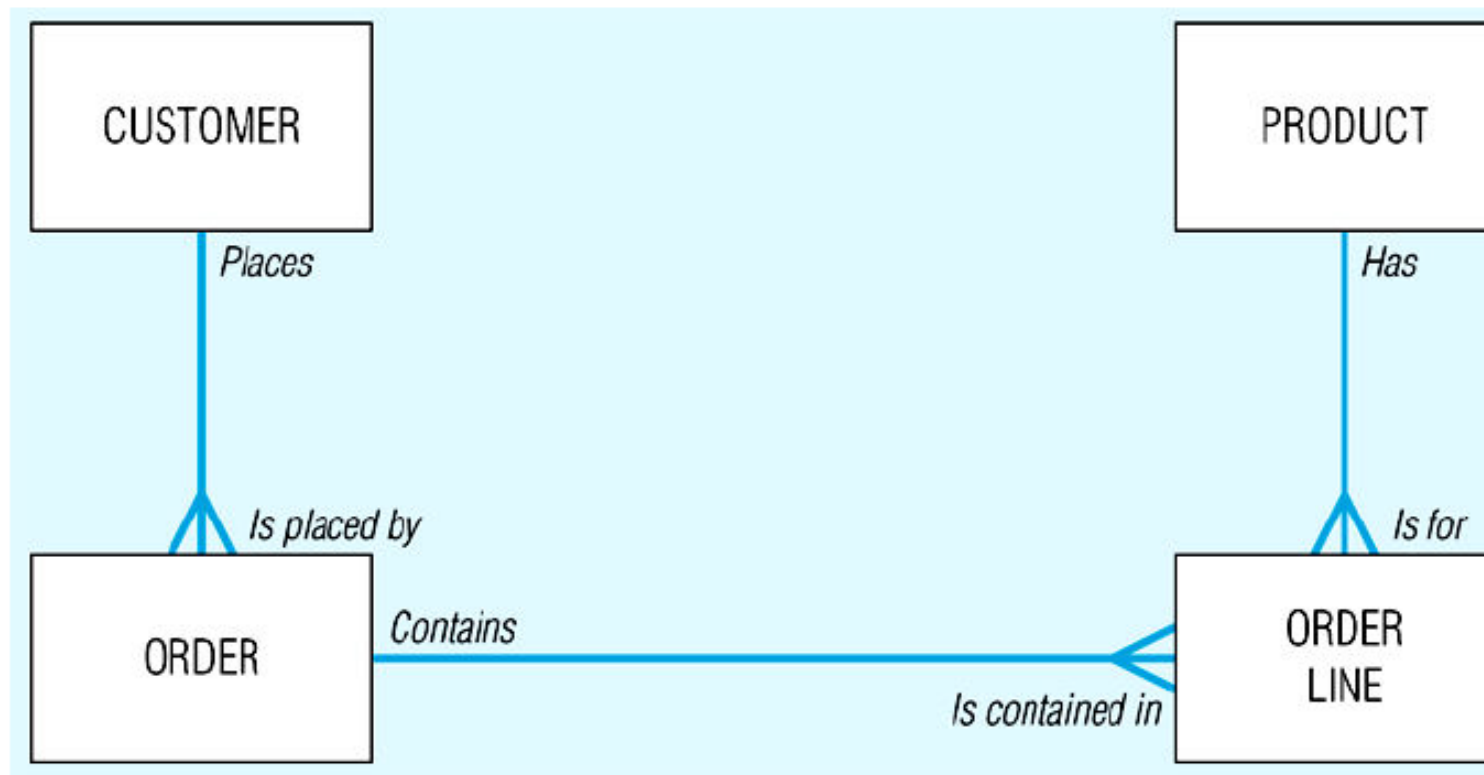
CUSTOMER	A person or an organization that buys or may potentially buy products from Pine Valley Furniture
ORDER	The purchase of one or more products by a customer
PRODUCT	The items Pine Valley Furniture makes and sells
ORDER LINE	Details about each product sold on a particular customer order (such as quantity and price)

Entities

1. Each CUSTOMER *Places* any number of ORDERs. Conversely, each ORDER *Is Placed By* exactly one CUSTOMER.
2. Each ORDER *Contains* any number of ORDER LINEs. Conversely, each ORDER LINE *Is Contained In* exactly one ORDER.
3. Each PRODUCT *Has* any number of ORDER LINEs. Conversely, each ORDER LINE *Is For* exactly one PRODUCT.

Business Rules

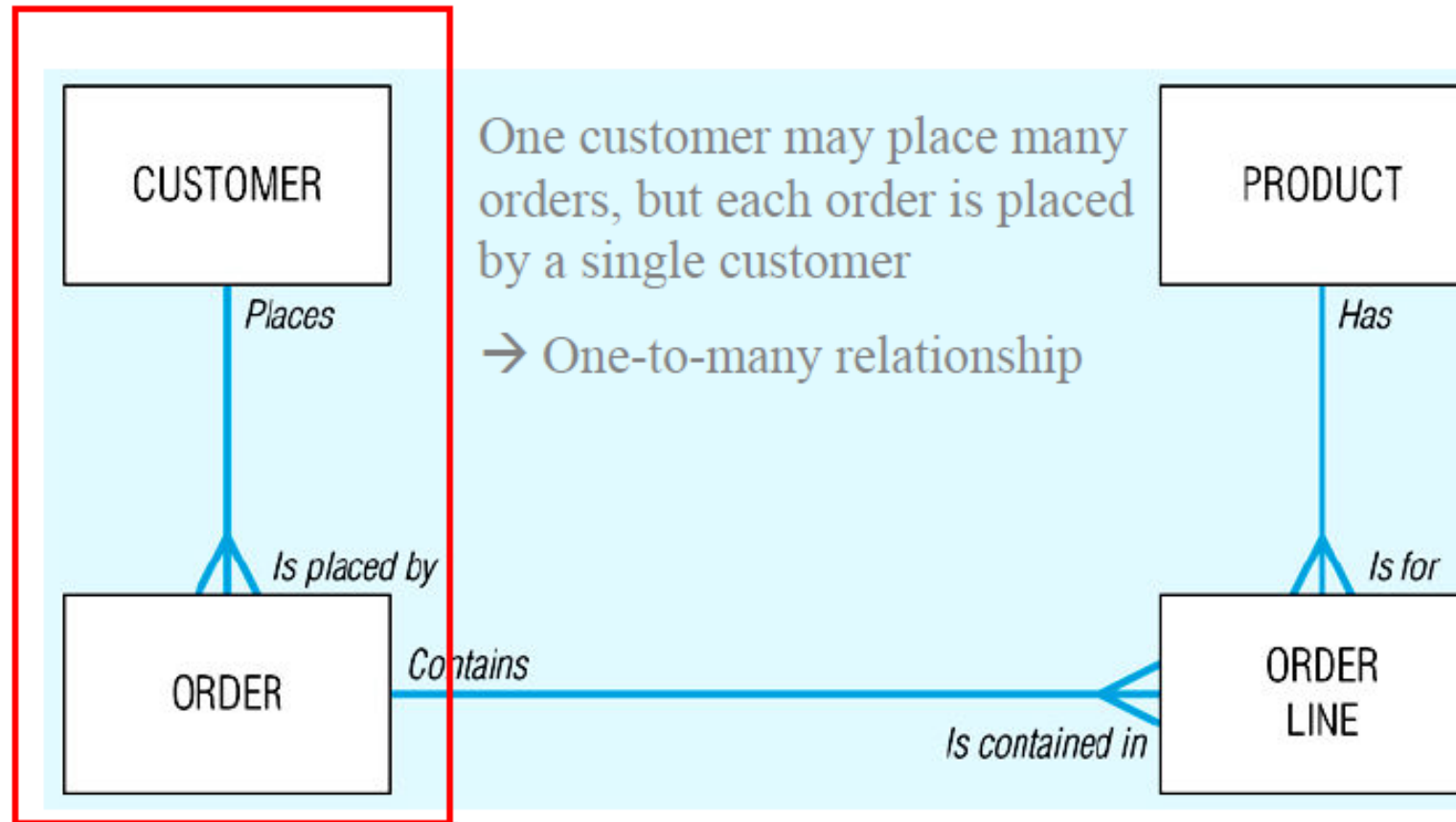
Initial Entity-Relationship Diagram



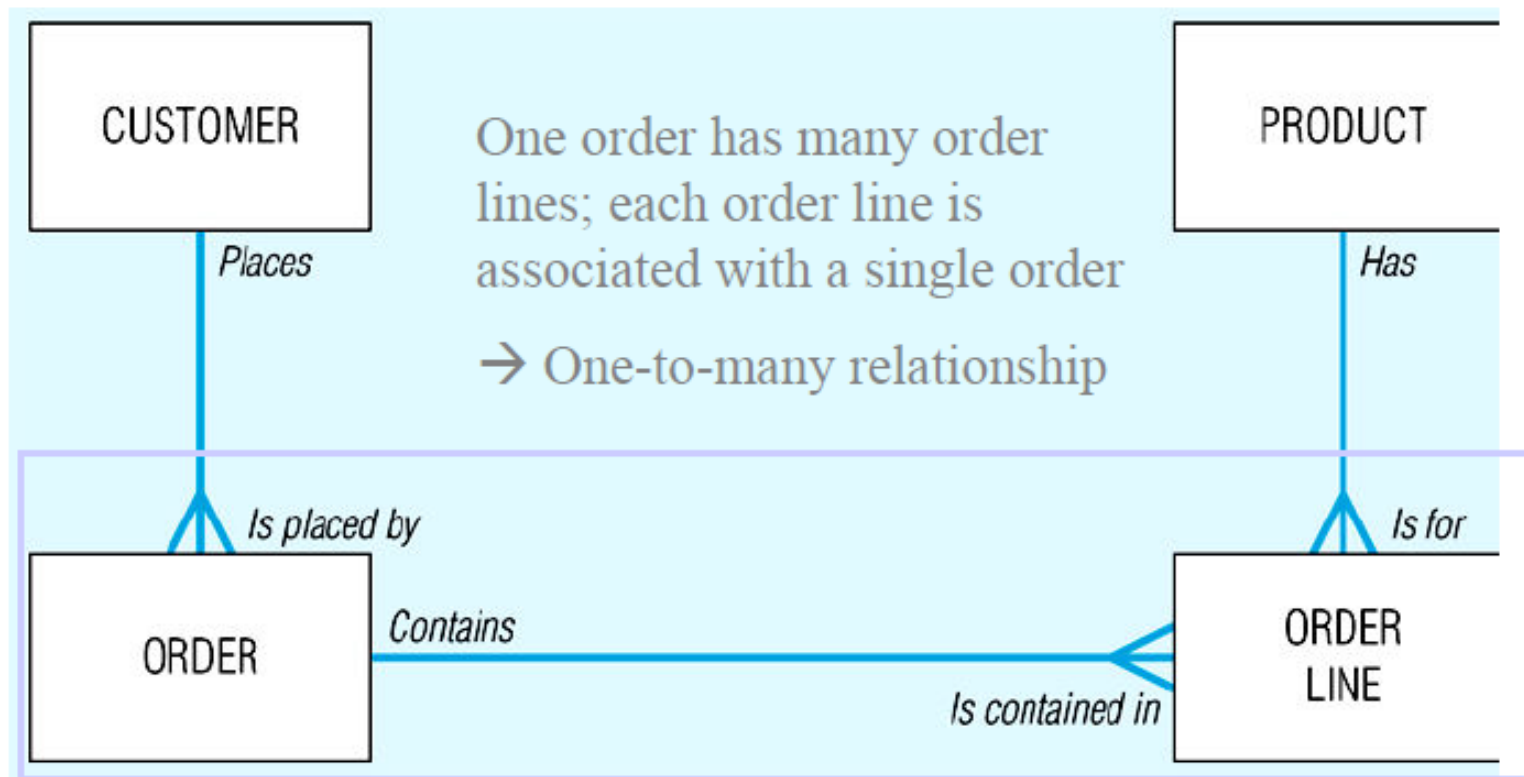
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Version 1

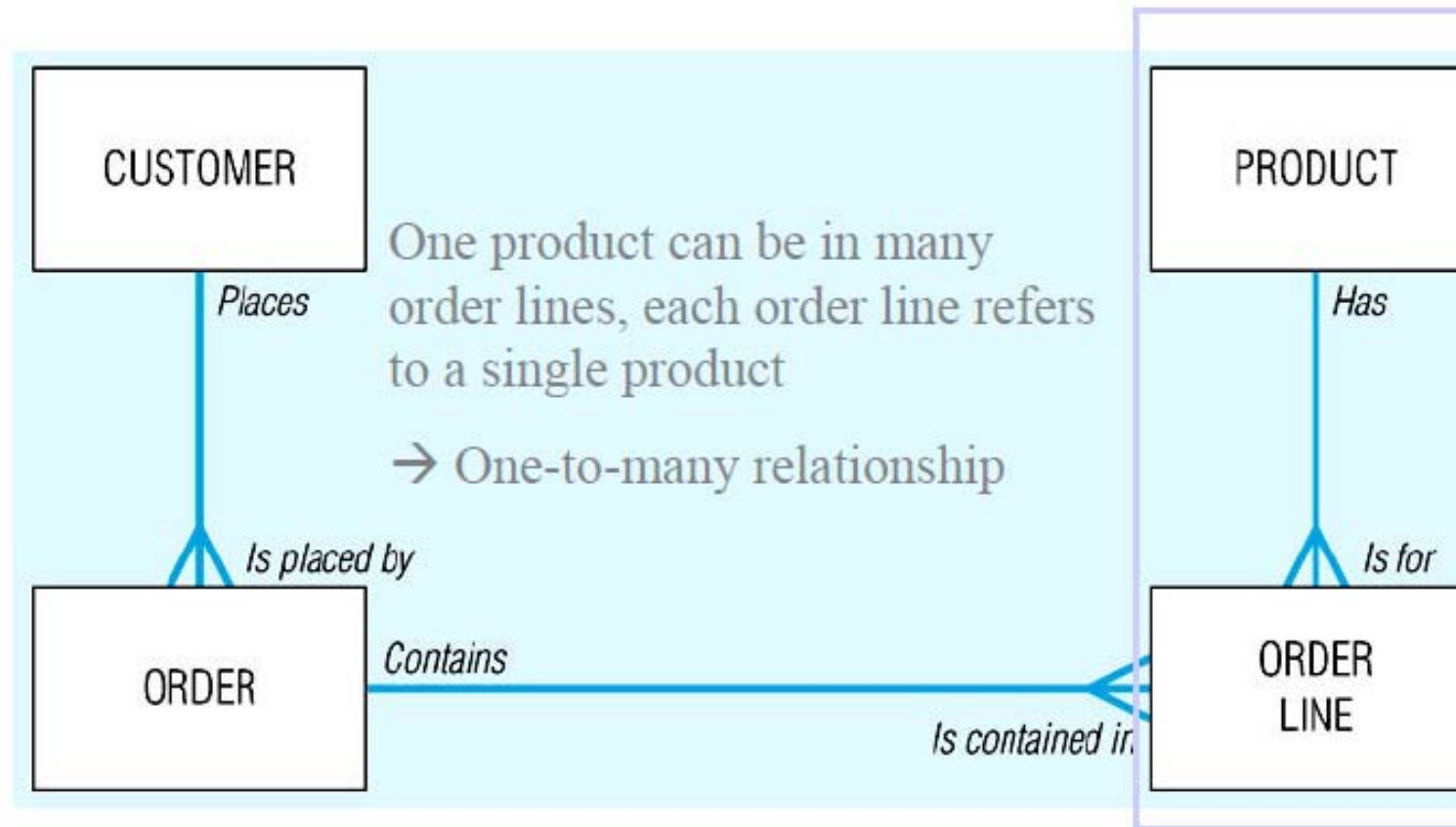
Initial Entity-Relationship Diagram (Cont.)



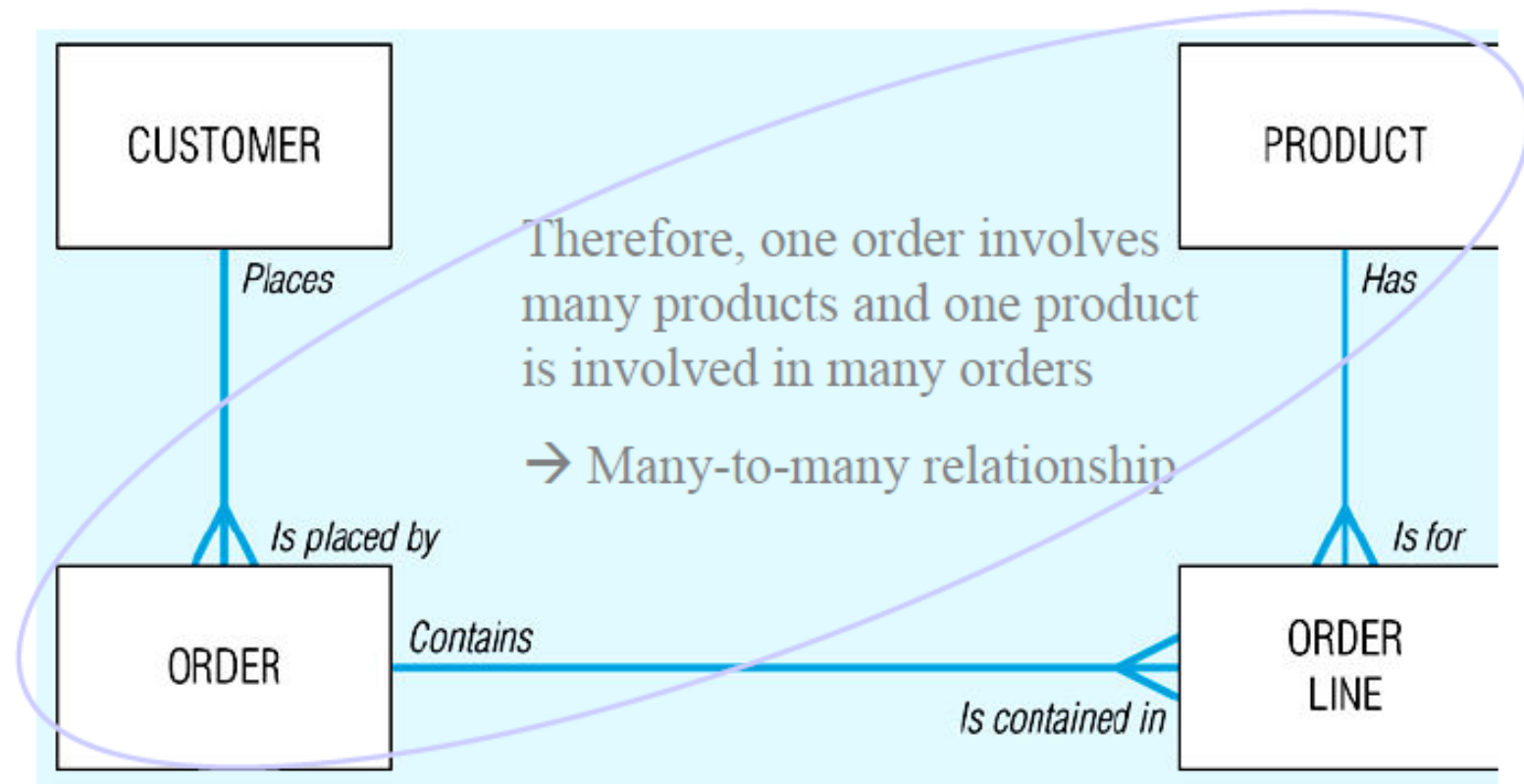
Initial Entity-Relationship Diagram (Cont.)



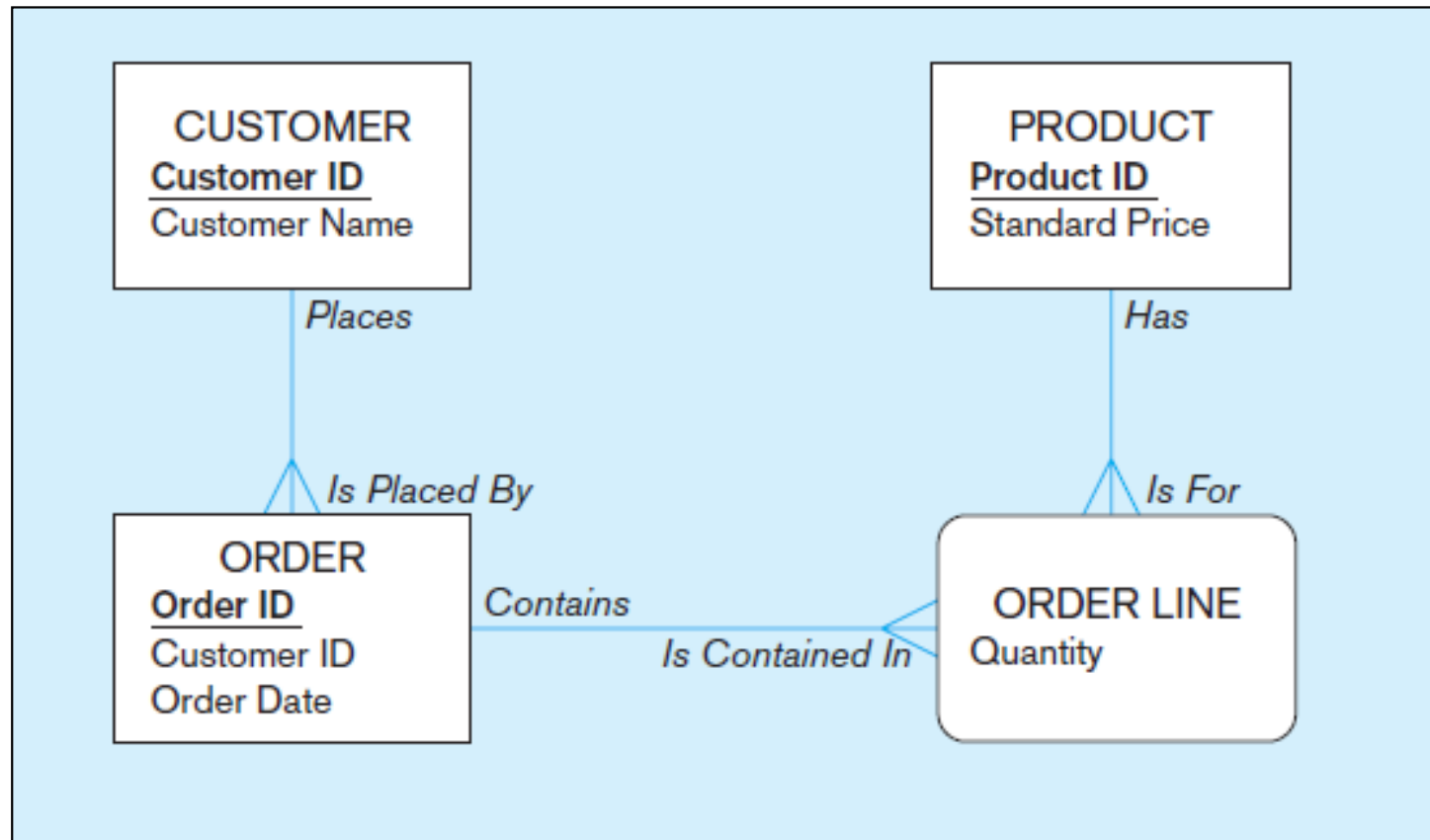
Initial Entity-Relationship Diagram (Cont.)



Initial Entity-Relationship Diagram (Cont.)



Initial Entity-Relationship Diagram (Cont.)



Version 2

Figure 1-3b: Segment from Enterprise Data Model

Figure 1-14: Four Relations

(a) Order and Order Line Tables

Order_T			
	OrderID	OrderDate	CustomerID
+	1001	10/21/2010	
+	1002	10/21/2010	
+	1003	10/22/2010	
+	1004	10/22/2010	
+	1005	10/24/2010	
+	1006	10/24/2010	
+	1007	10/27/2010	
+	1008	10/30/2010	
+	1009	11/5/2010	
+	1010	11/5/2010	
Record: 1 of 10 No Filter Search			

OrderLine_T			
	OrderID	ProductID	OrderedQuantity
	1001	1	2
	1001	2	2
	1001	4	1
	1002	3	5
	1003	3	3
	1004	6	2
	1004	8	2
	1005	4	4
	1006	4	1
	1006	5	2
	1006	7	2
	1007	1	3
	1007	2	2
	1008	3	3
	1008	8	3
	1009	4	2
	1009	7	3
	1010	8	10
*	0	0	0
Record: 1 of 18 No Filter Search			

Figure 1-14: Four Relations (Cont.)

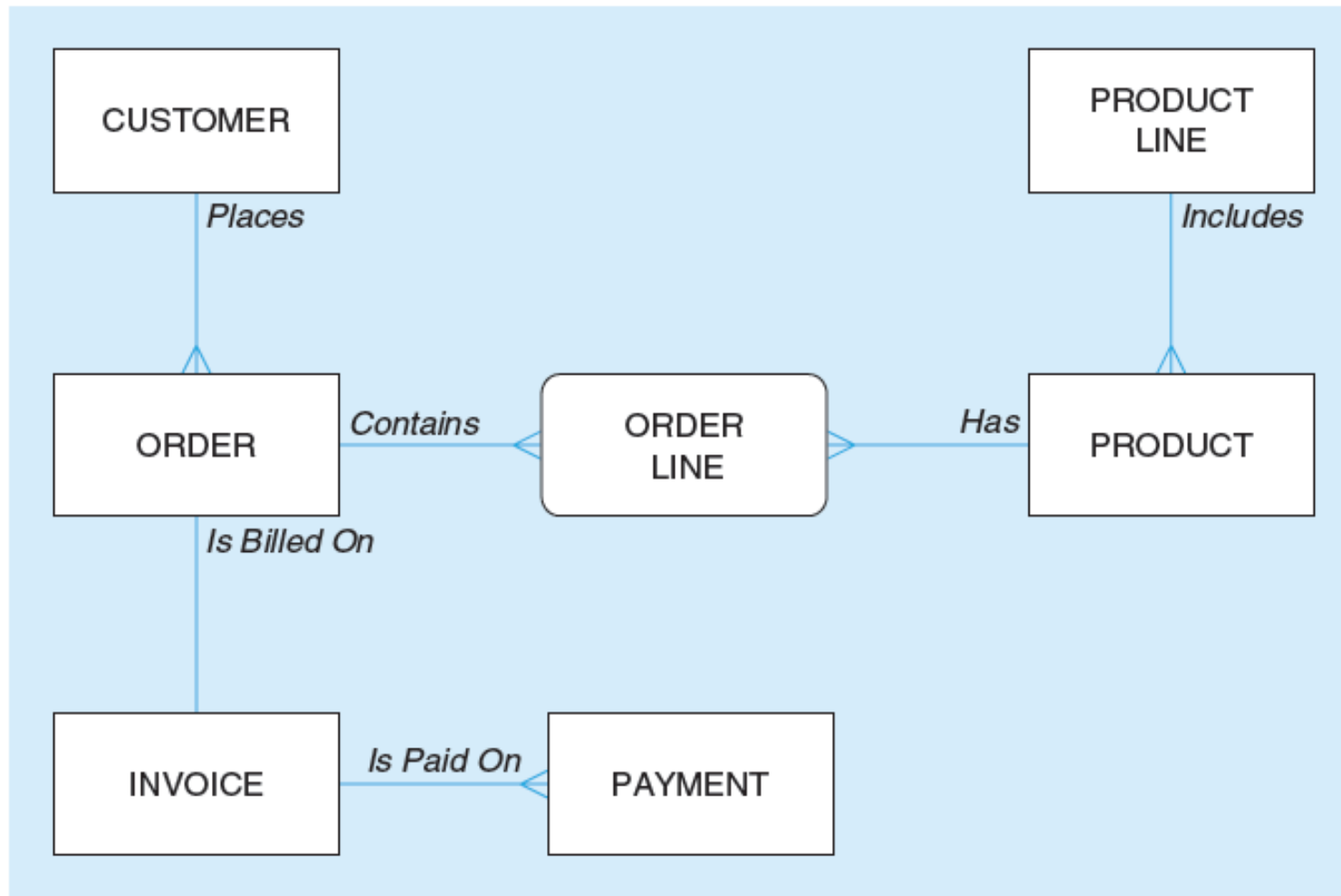
Customer_T		
	CustomerID	CustomerName
+	1	Contemporary Casuals
+	2	Value Furniture
+	3	Home Furnishings
+	4	Eastern Furniture
+	5	Impressions
+	6	Furniture Gallery
+	7	Period Furniture
+	8	California Classics
+	9	M and H Casual Furniture
+	10	Seminole Interiors
+	11	American Euro Lifestyles
+	12	Battle Creek Furniture
+	13	Heritage Furnishings
+	14	Kaneohe Homes
+	15	Mountain Scenes
*	(New)	

(b) Customer table

Product_T		
	ProductID	ProductStandardPrice
+	1	\$175.00
+	2	\$200.00
+	3	\$375.00
+	4	\$650.00
+	5	\$325.00
+	6	\$750.00
+	7	\$800.00
+	8	\$250.00
*	(New)	\$0.00

(c) Product table

Figure 1-15: Preliminary Data Model for Home Office Product Line Marketing



Version 3

Data Attributes for Entities in Preliminary Data Model

TABLE 1-6 Data Attributes for Entities in the Preliminary Data Model (Pine Valley Furniture Company)

Entity Type	Attribute
Customer	Customer Identifier
	Customer Name
	Customer Type
	Customer Zip Code
Product	Product Identifier
	Product Description
	Product Finish
	Product Price
	Product Cost
	Product Annual Sales Goal
Product Line	Product Line Name
	Product Line Name
	Product Line Annual Sales Goal

Data Attributes for Entities in Preliminary Data Model (Cont.)

Order

Order Number

Order Placement Date

Order Fulfillment Date

Customer Identifier

Ordered Product

Order Number

Product Identifier

Order Quantity

Invoice

Invoice Number

Order Number

Invoice Date

Payment

Invoice Number

Payment Date

Payment Amount

Data Attributes for Entities in Final Data Model

TABLE 1-7 Data Attributes for Entities in Final Data Model (Pine Valley Furniture Company)

Entity Type	Attribute
Customer	Customer Identifier
	Customer Name
	Customer Type
	Customer Zip Code
	Customer Years
Product	Product Identifier
	Product Description
	Product Finish
	Product Price
	Product Cost
	<i>Product Prior Year Sales Goal</i>
	<i>Product Current Year Sales Goal</i>
Product Line	Product Line Name
	<i>Product Line Prior Year Sales Goal</i>
	<i>Product Line Current Year Sales Goal</i>

Data Attributes for Entities in Final Data Model (Cont.)

Order	Order Number Order Placement Date Order Fulfillment Date <i>Order Number of Shipments</i> Customer Identifier
Ordered Product	Order Number Product Identifier Order Quantity
Invoice	Invoice Number Order Number Invoice Date
Payment	Invoice Number Payment Date Payment Amount

**Changes from preliminary list of attributes appear in italics.*

SQL Definitions

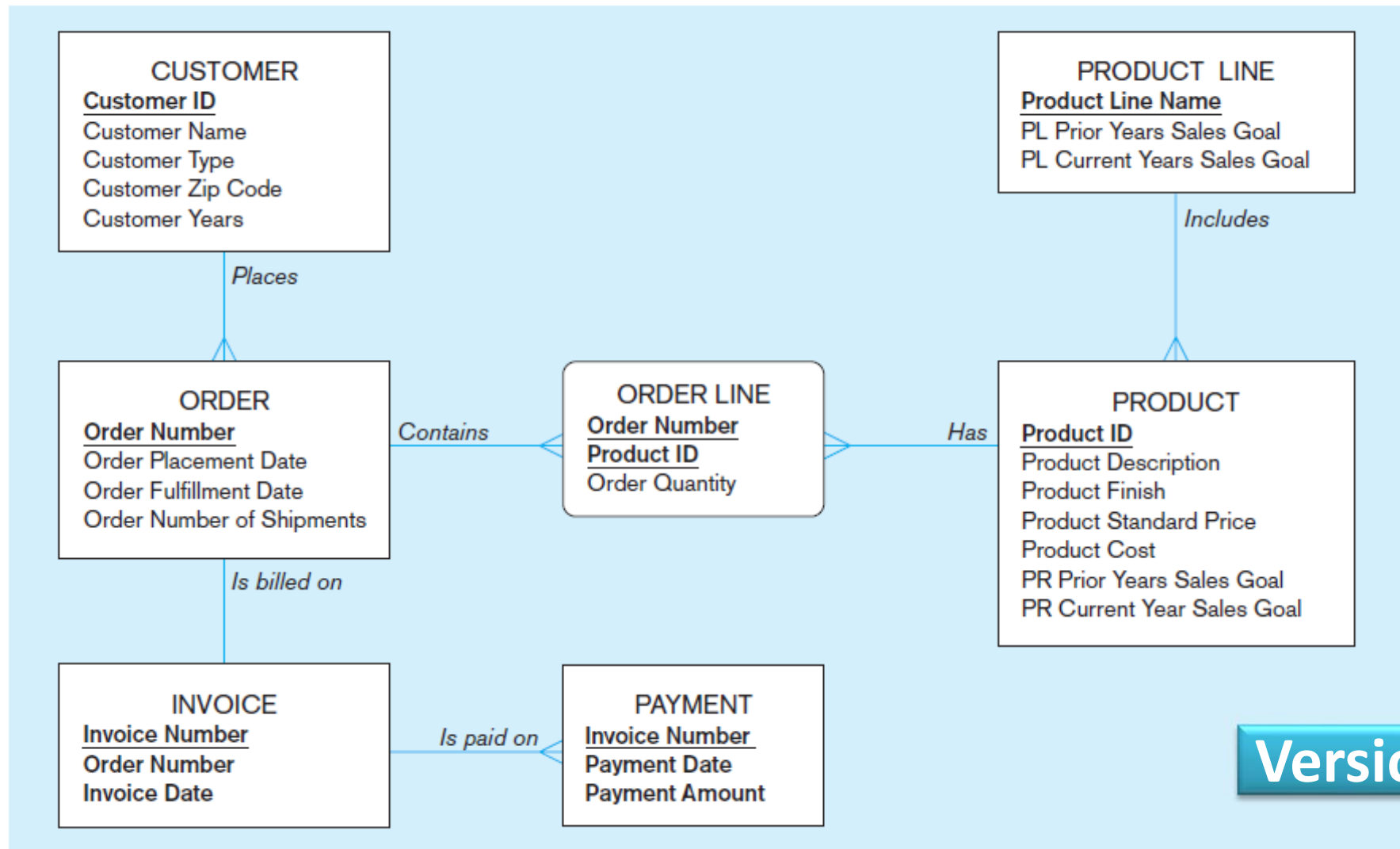
FIGURE 1-16 SQL definition of ProductLine table

```
CREATE TABLE ProductLine_T  
  
(ProductLineID    VARCHAR (40) NOT NULL PRIMARY KEY,  
  
PIPriorYearGoal   DECIMAL,  
  
PICurrentYearGoal DECIMAL);
```

FIGURE 1-17 SQL definition of Product table

```
CREATE TABLE Product_T  
  
(ProductID        NUMBER(11,0) NOT NULL PRIMARY KEY  
  
ProductDescription VARCHAR (50),  
  
ProductFinish     VARCHAR (20),  
  
ProductStandardPrice DECIMAL(6,2),  
  
ProductCost       DECIMAL,  
  
ProductPriorYearGoal DECIMAL,  
  
ProductCurrentYearGoal DECIMAL,  
  
ProductLineID     VARCHAR (40),  
  
FOREIGN KEY        (ProductLineID) REFERENCES ProductLine_T (ProductLineID));
```


Project Data Model



Version 4

Figure 1-18: Project Data Model for Home Office Product Line Marketing Support Sys.

SQL Query & its Result

FIGURE 1-19 SQL query for Home Office sales-to-goal comparison

```
SELECT Product.ProductID, Product.ProductDescription, Product.PRCurrentYearSalesGoal,
       (OrderQuantity * ProductPrice) AS SalesToDate
FROM Order.OrderLine, Product.ProductLine
WHERE Order.OrderNumber = OrderLine.OrderNumber
AND Product.ProductID = OrderedProduct.ProductID
AND Product.ProductID = ProductLine.ProductID
AND Product.ProductLineName = "Home Office";
```

FIGURE 1-20 Home Office product line sales comparison

Home Office Sales to Date : Select Query				
	Product ID	Product Description	PR Current Year Sales Goal	Sales to Date
	3	Computer Desk	\$23,500.00	5625
	10	96" Bookcase	\$22,500.00	4400
	5	Writer's Desk	\$26,500.00	650
	3	Computer Desk	\$23,500.00	3750
	7	48" Bookcase	\$17,000.00	2250
	5	Writer's Desk	\$26,500.00	3900
▶				

Front-end & Back-end Databases

- The front end of a website is the part that users interact with. Also referred to as client-side, it includes everything that you see when you're navigating around the Internet, from fonts and colors to dropdown menus and sliders, is a combo of HTML, CSS, and JavaScript being controlled by your computer's browser.
- The back end of a website consists of a server, an application, and a database. Also referred as server-side. A back-end developer builds and maintains the technology that powers those components which, together, enable the client-side to even exist in the first place. Some common backend languages are PHP, Java, .Net, Python, and Rails.
- Full Stack Development

Summary

- Discussed various types of data models and logical & physical database design
- Discussed SDLC, Prototyping, and DBLC
- Covered a sample Case Study
- Discussed Front-end and Back-end Databases