Introduction to Database Management

Outline

- Database characteristics
- DBMS features
- Architectures
- Organizational roles

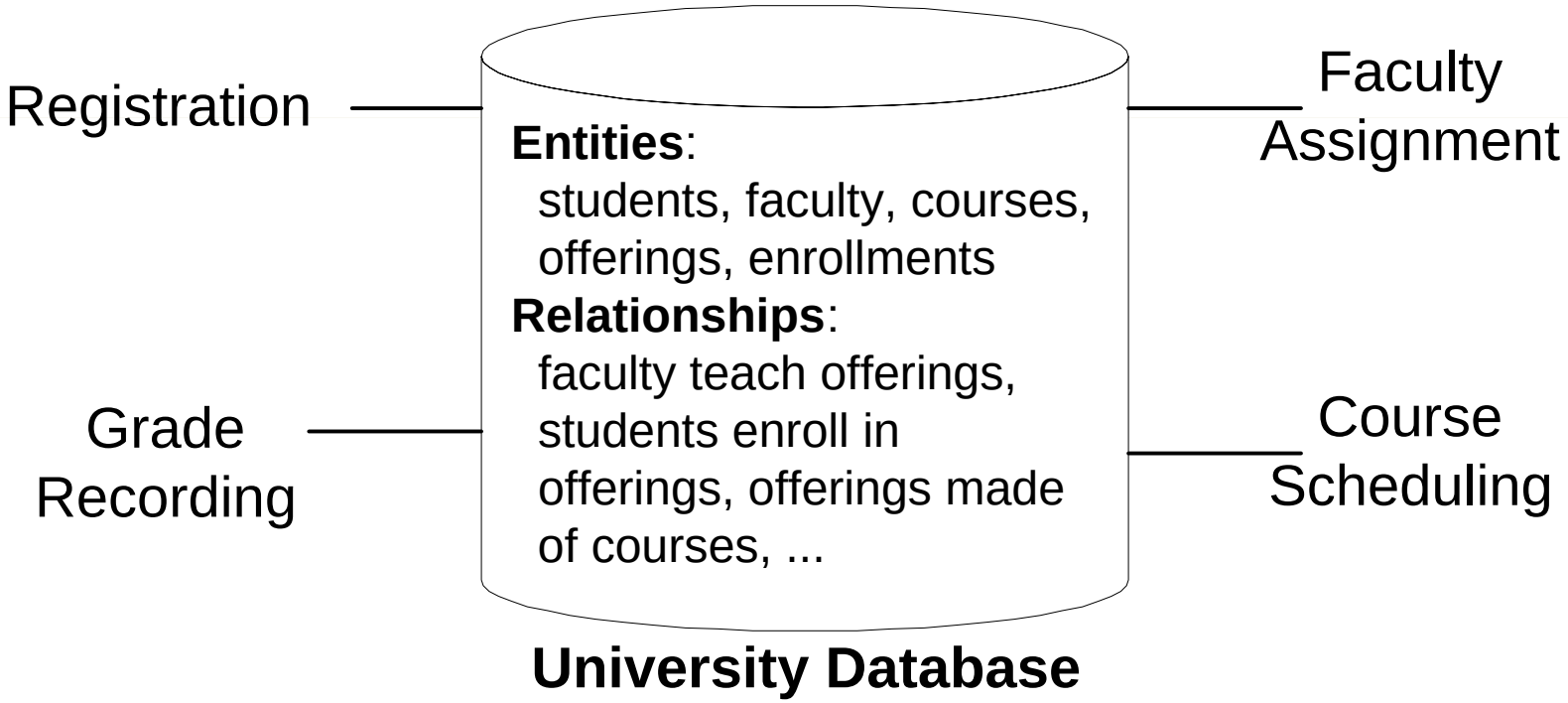
Initial Vocabulary

- Data: raw facts about things and events
- Information: transformed data that has value for decision making
- Essential to organize data for retrieval and maintenance

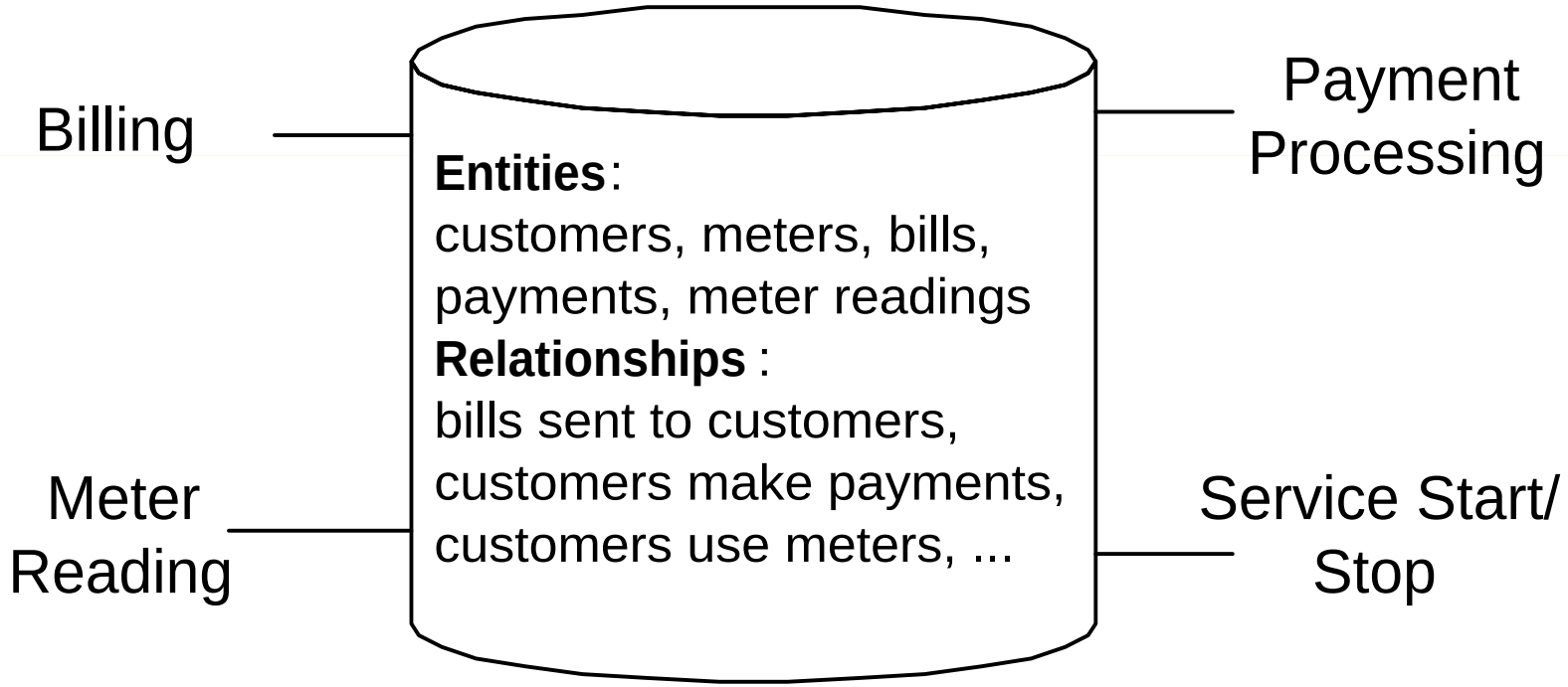
Database Characteristics

- Persistent : stable storage
- Shared : multiple users and uses
- Interrelated : data stored as entities and relationships

University Database



Water Utility Database



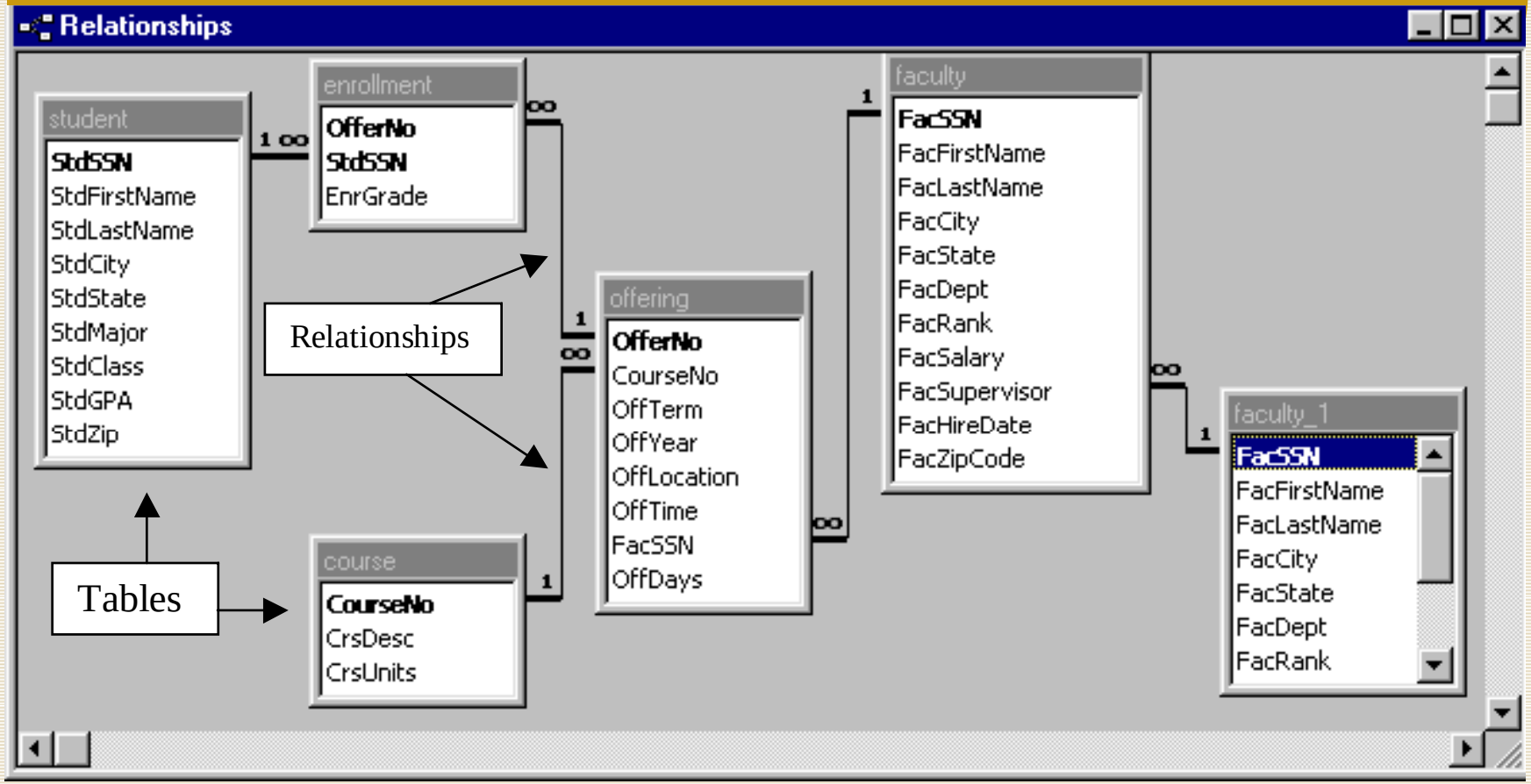
Database Management System (DBMS)

- Collection of components that support data acquisition, dissemination, storage, maintenance, retrieval, and formatting
- Enterprise DBMSs
- Desktop DBMSs
- Embedded DBMSs
- Major part of information technology infrastructure

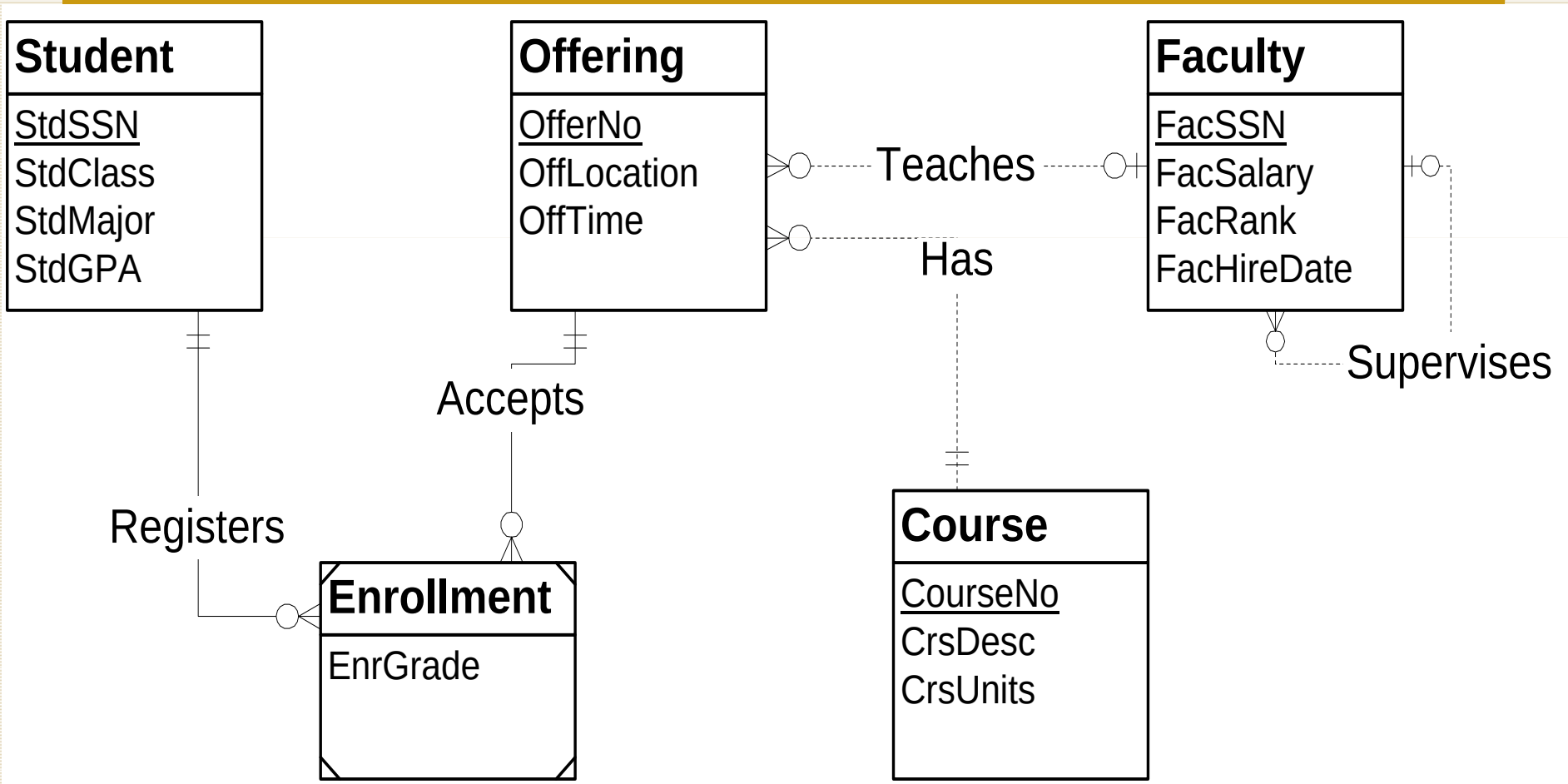
Database Definition

- Define database structure before using a database
- Tables and relationships
- SQL CREATE TABLE statement
- Graphical tools

University Database



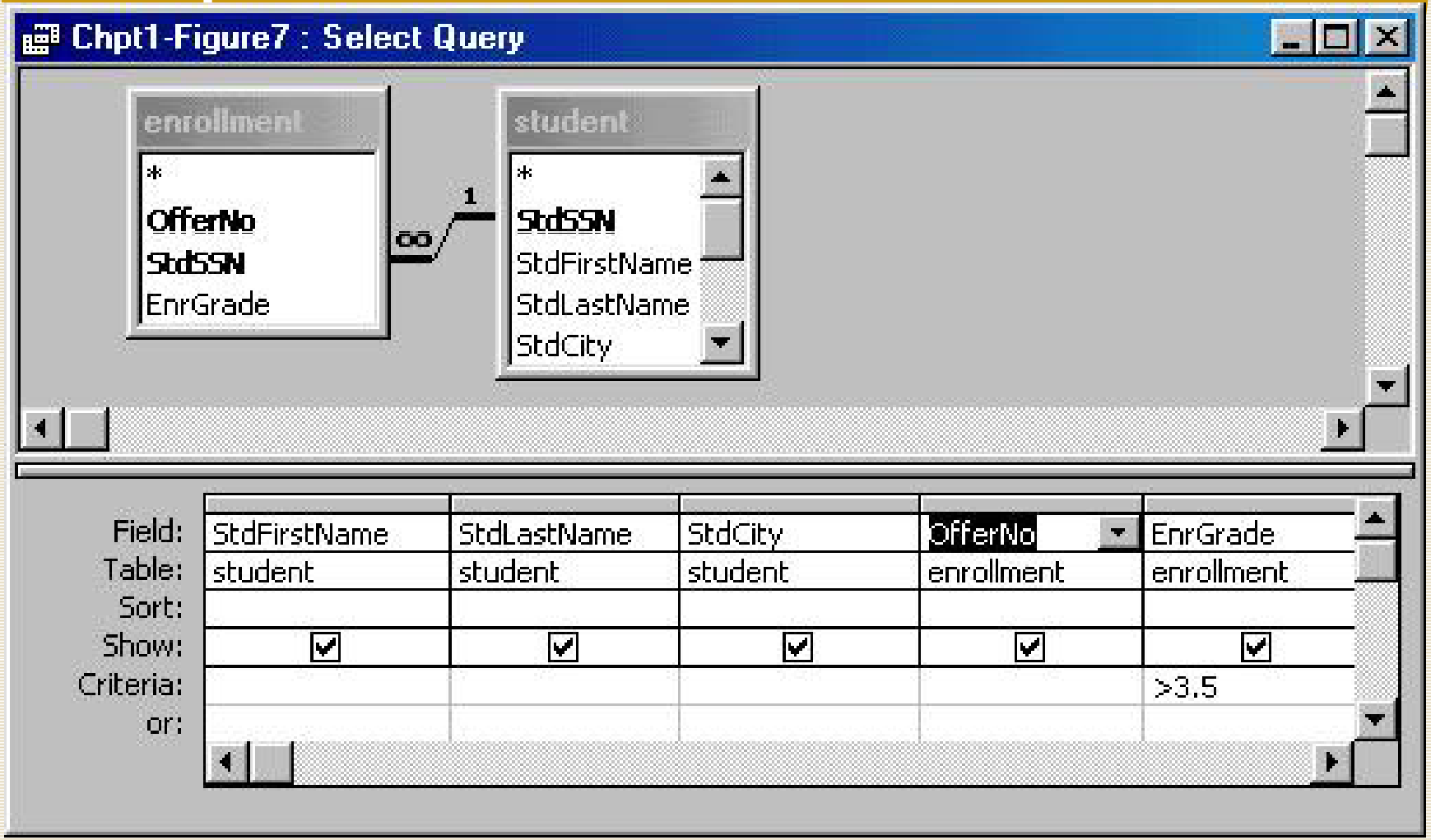
University Database (ERD)



Nonprocedural Access

- Query: request for data to answer a question
- Indicate what parts of database to retrieve not the procedural details
- Improve productivity and improve accessibility
- SQL SELECT statement and graphical tools

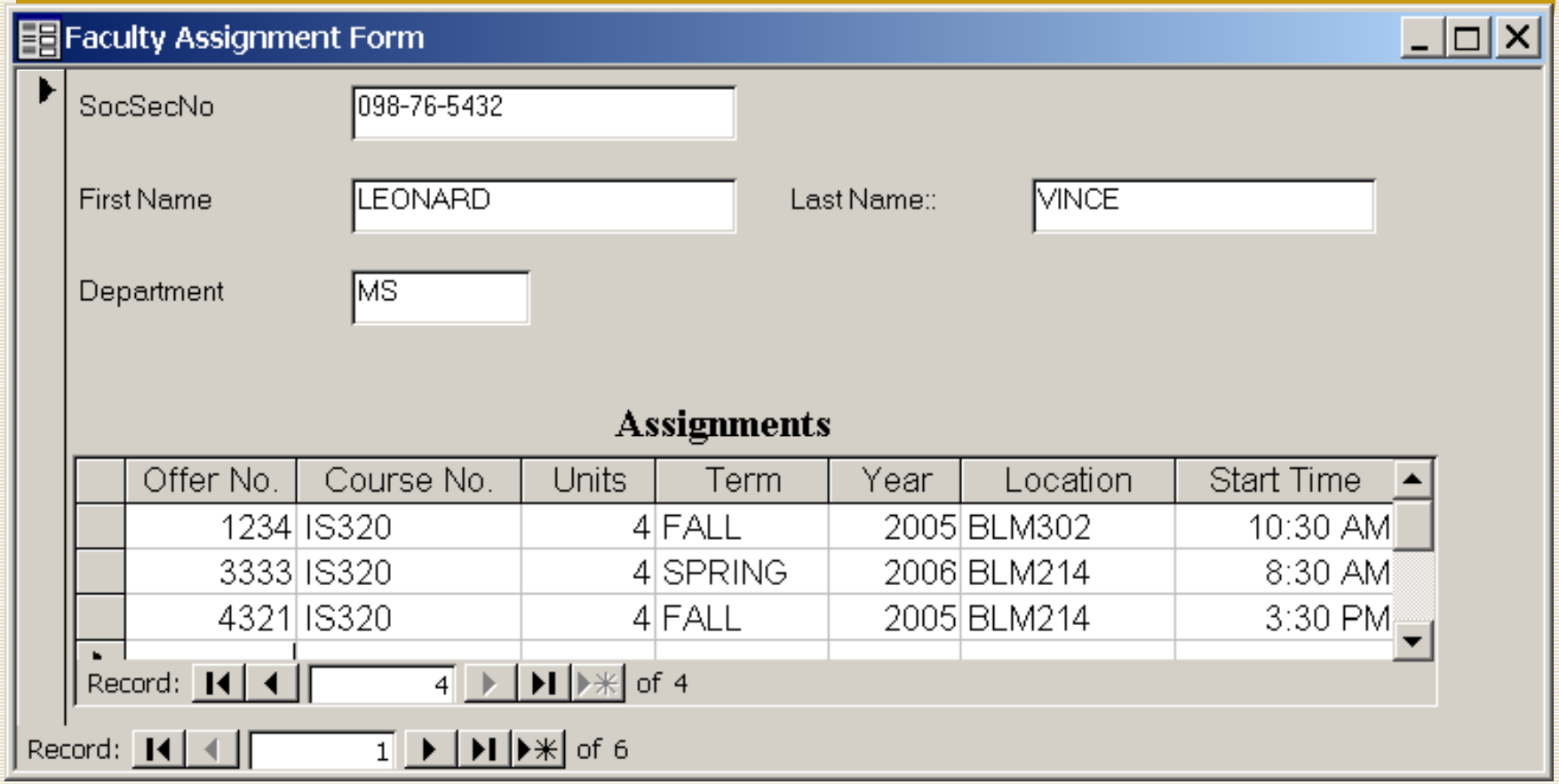
Graphical Tool for Nonprocedural Access



Application Development

- Form: formatted document for data entry and display
- Report: formatted document for display
- Use nonprocedural access to specify data requirements of forms and reports

Sample Data Entry Form



Sample Report

Faculty Work Load Report for the 2005-2006 Academic Year

Department	Name	Term	Offer Number	Units	Limit	Enrollment	Percent Full	Low Enrollment
FIN								
	JULIA MILLS							
		WINTER	5678	4	20	1	5.00%	☑
		Summary for 'term' = WINTER (1 detail record)						
		Sum		*4*		*1*		
		Avg					*5.00%*	
	Summary for JULIA MILLS							
	Sum			*4*		*1*		
	Avg						*5.00%*	
Summary for 'department' = FIN (1 detail record)								

Procedural Language Interface

- Combine procedural language with nonprocedural access
- Why
  - Batch processing
  - Customization and automation
  - Performance improvement

Transaction Processing

- Transaction: unit of work that should be reliably processed
- Control simultaneous users
- Recover from failures

Database Technology Evolution

Era	Generation	Orientation	Major Features
1960s	1st Generation	File	File structures and proprietary program interfaces
1970s	2nd Generation	Network Navigation	Networks and hierarchies of related records, standard program interfaces
1980s	3rd Generation	Relational	Non-procedural languages, optimization, transaction processing
1990s	4th Generation	Object	Multi-media, active, distributed processing, XML enabled

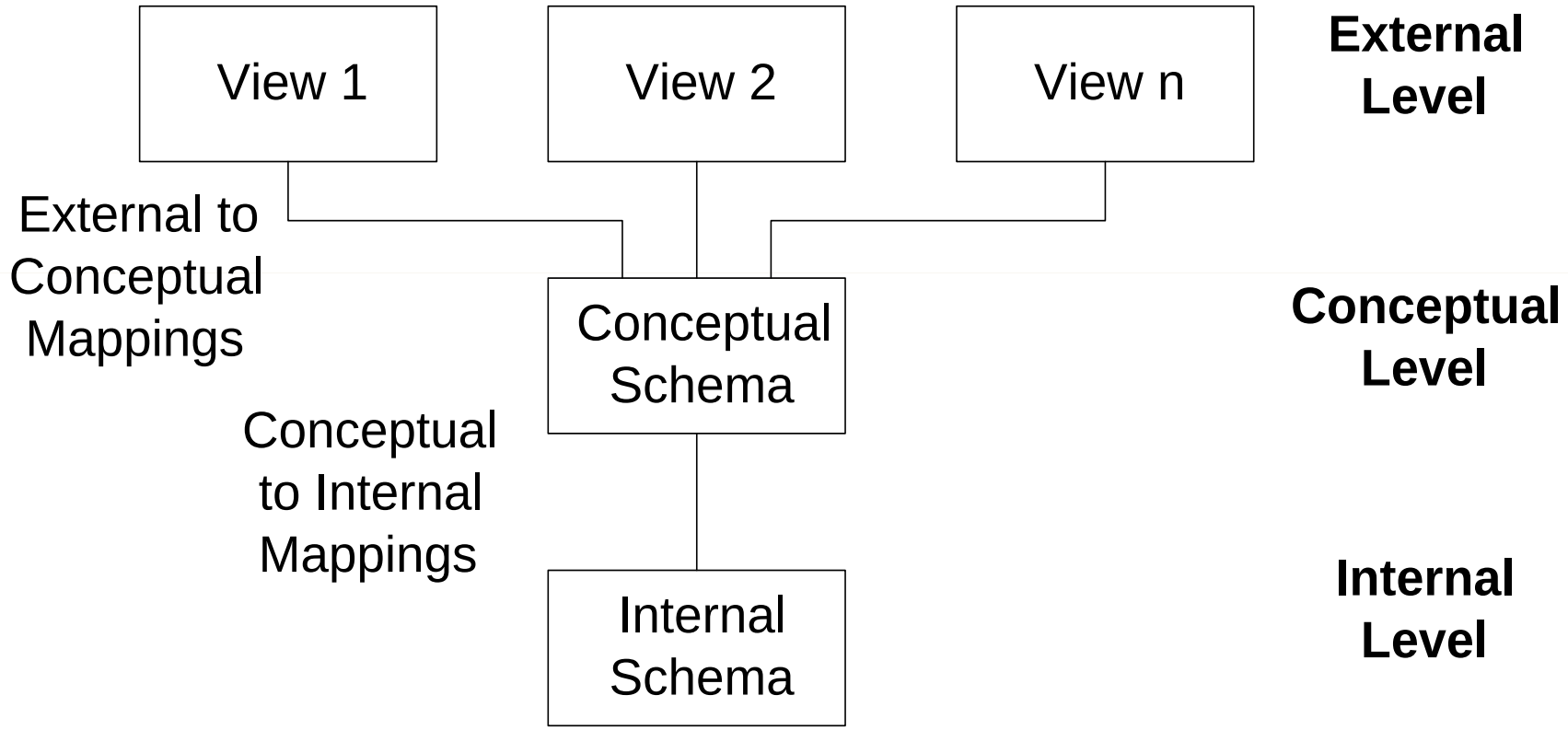
DBMS Marketplace

- Enterprise DBMS
  - Oracle: dominates in Unix; strong in Windows
  - SQL Server: strong in Windows
  - DB2: strong in mainframe environment
  - Significant open source DBMSs: MySQL, Firebird, PostgreSQL
- Desktop DBMS
  - Access: dominates
  - FoxPro, Paradox, Approach, FileMaker Pro

Data Independence

- Software maintenance is a large part (50%) of information system budgets
- Reduce impact of changes by separating database description from applications
- Change database definition with minimal effect on applications that use the database

Three Schema Architecture

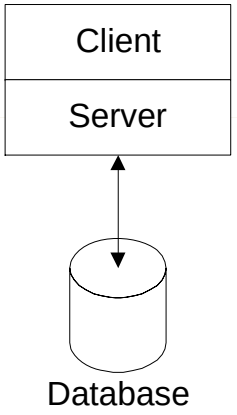


Differences among Levels

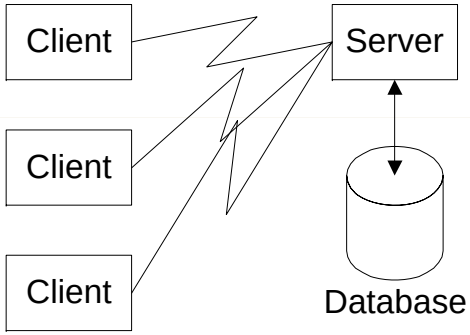
- External
  - Forms
  - Reports
- Conceptual
  - Tables
- Internal
  - Files needed to store the tables
  - Extra files to improve performance

Client-Server Architecture

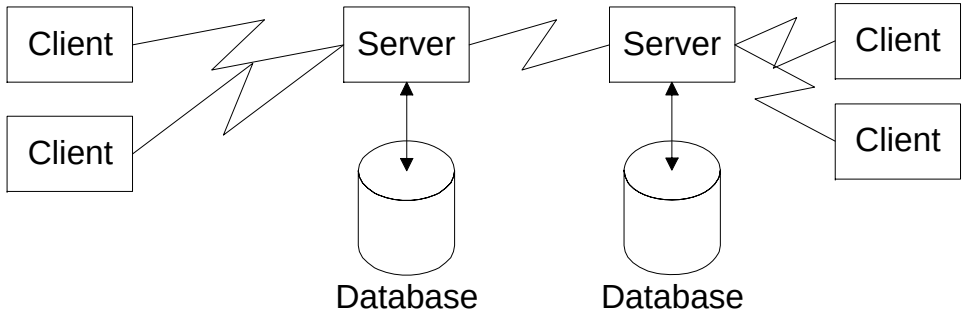
a) Client, server, and database on the same computer



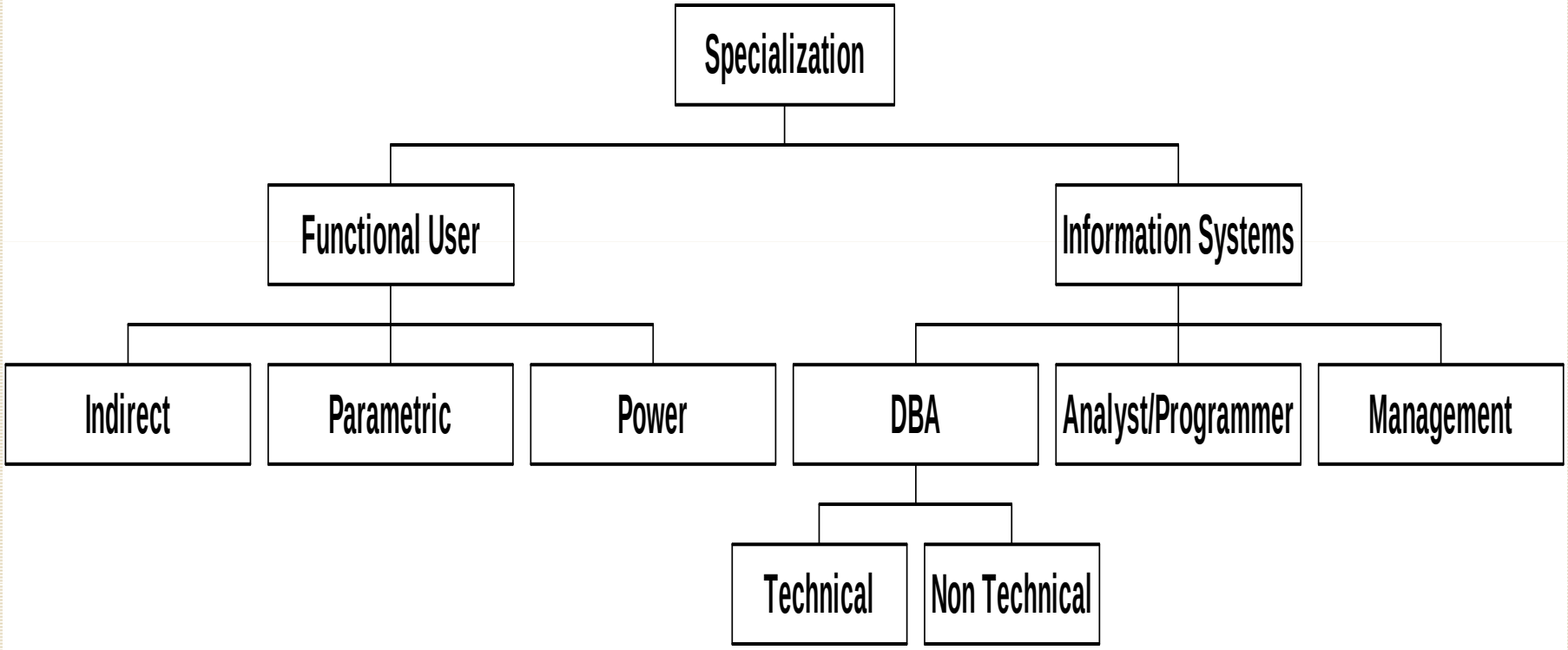
b) Mulitple clients and 1 server on different computers



c) Multiple servers and databases on different computers



Organizational Roles



Database Specialists

- Database administrator (DBA)
  - More technical
  - DBMS specific skills
- Data administrator
  - Less technical
  - Planning role

Summary

- Databases and database technology vital to modern organizations
- Database technology supports daily operations and decision making
- Nonprocedural access is a crucial feature
- Many opportunities to work with databases