Last Class

- What is a database and a database system
- Why use a database
  - Data independence

Data Independence

- Immunity of applications to change in physical representations and access technique
- major objective for database systems
- Two type data independence
  - Physical data independence
  - Logical data independence

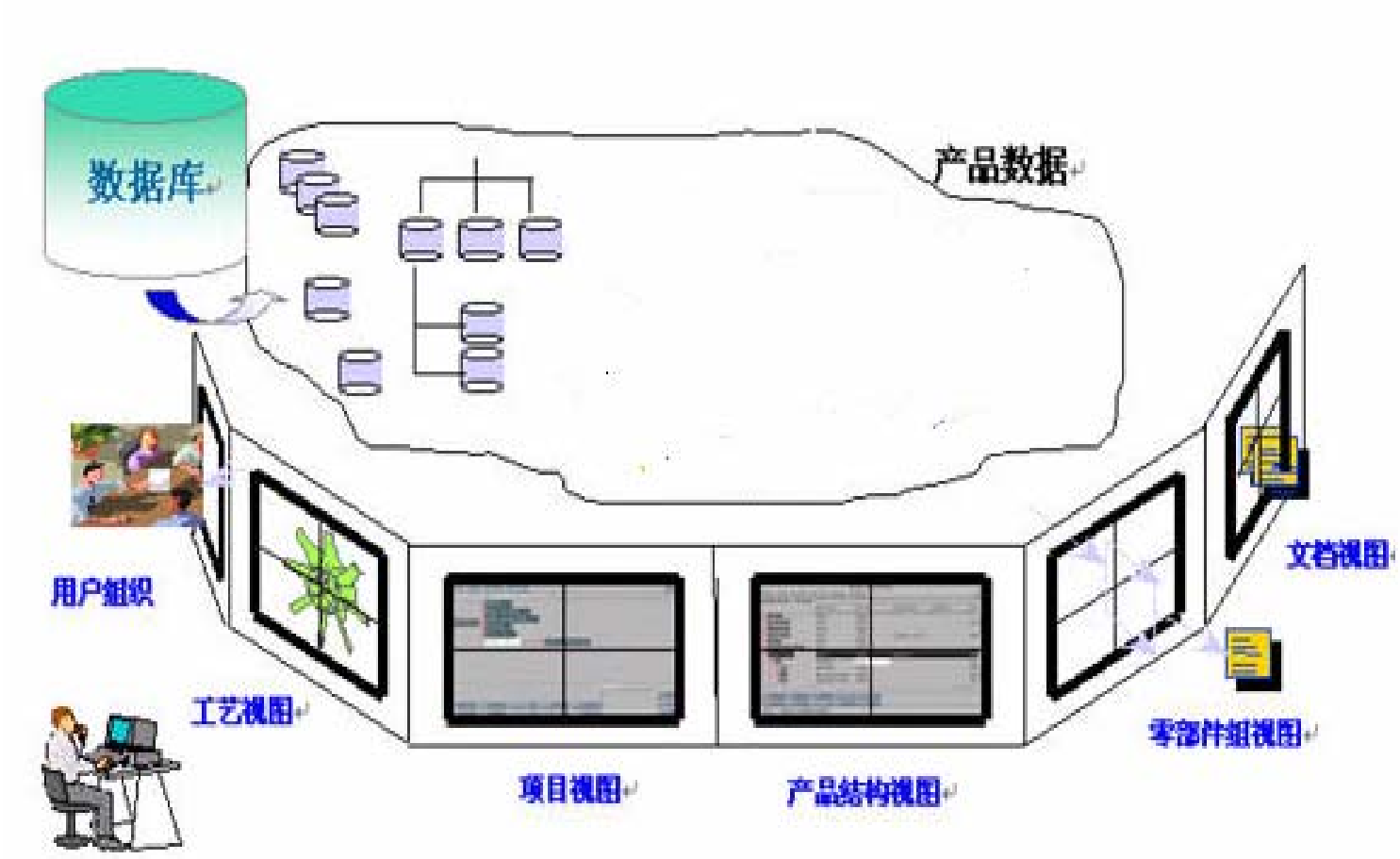
Data Independence - Cont.

- Data dependent

  data physical representation and access techniques are built into the application code (eg. File system)

Data Independence - Cont.

- database system need data independence
  - different application will requires different view of the same data
  - DBA must have the freedom to change the physical representation or access technique in response to modify existing applications


数据库
产品数据
用户组织
工艺视图
项目视图
产品结构视图
文档视图
零部件组视图

Data Independence - Cont.

- Data physical representation
  - Stored field - smallest unit of stored data
  - Stored record - collection of related stored field
  - Stored file - collection of all currently existing occurrences of one type of stored record
- Type with Occurrence (or instance)

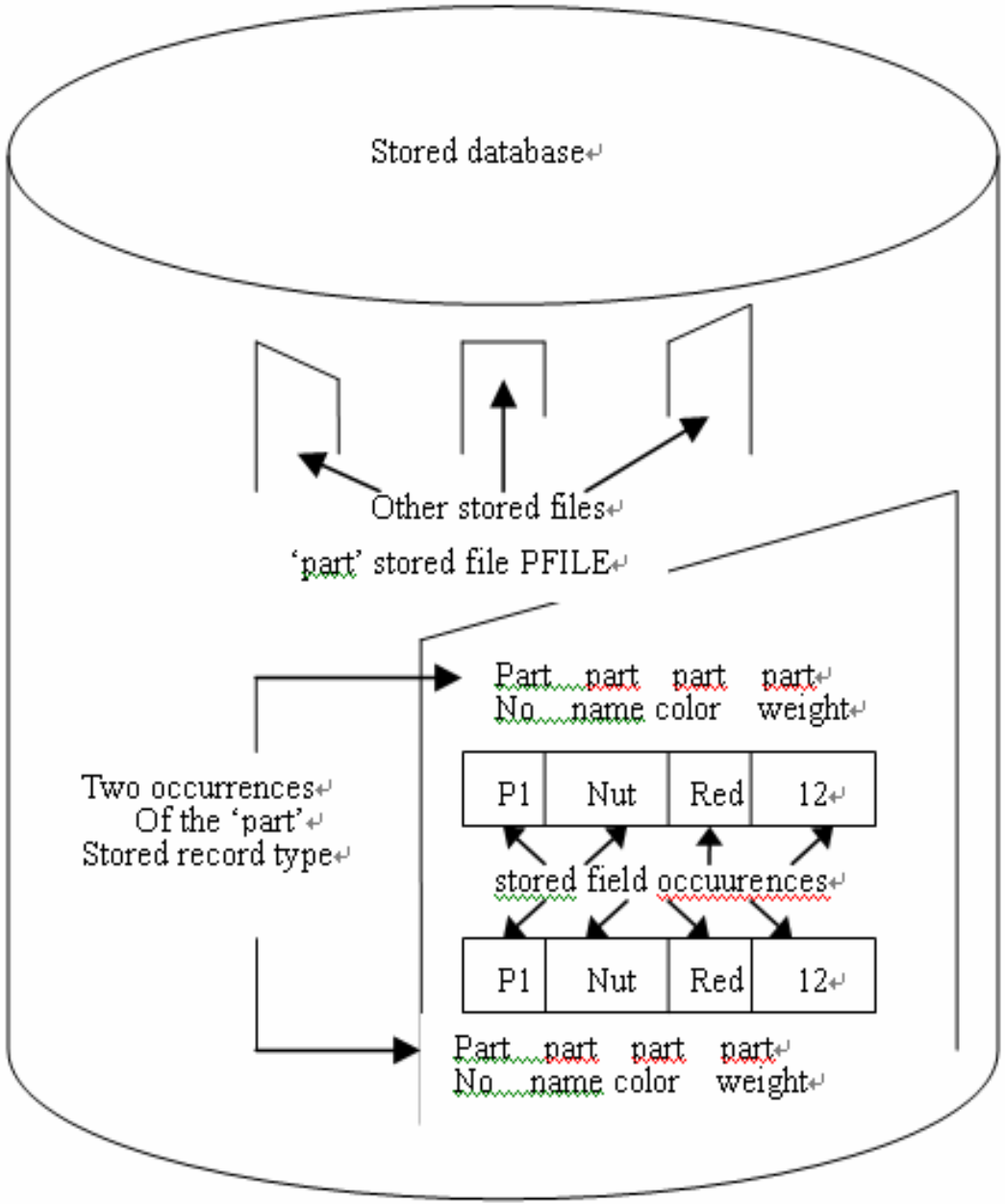


Fig 1.7 Stored fields, records,and files

Data Independence - Cont.

- List of the stored representation that might be subject to change
  - representation of numeric data
  - representation of character data
  - unit for numerical data
  - data coding
  - data materialization (direct / indirect)
  - structure of stored record
  - structure of stored files

Data Base Systems

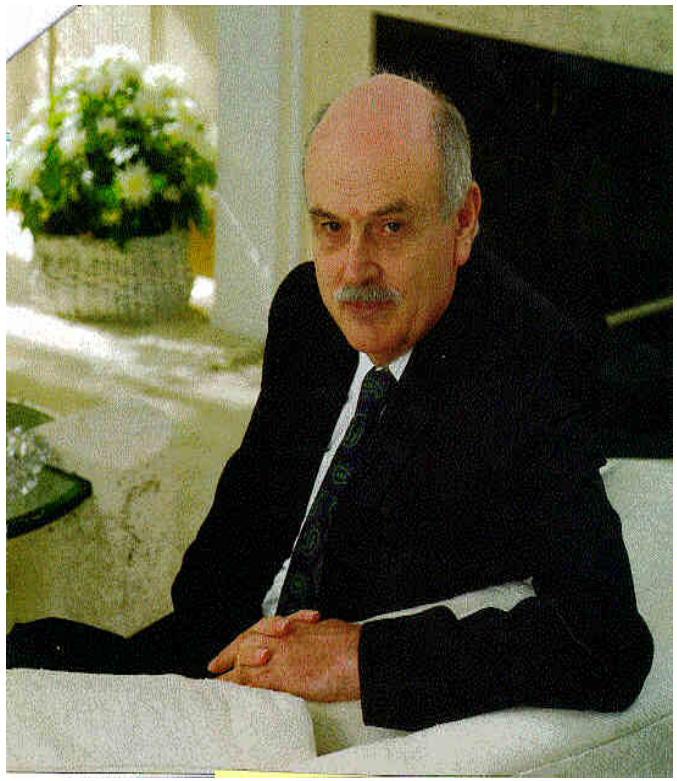
- Hierarchical system (1960s)
  - C.W. Bachman IDS (Integrated Data Store)
  - data represent to is the form of tree structure
  - operator traversing pointers
  - data shared by several applications
- Network System (1970s)
  - CODASYL DBTG Report
  - data represent to user is graph structure
  - operator similar to hierarchical system

Data Base Systems-cont.

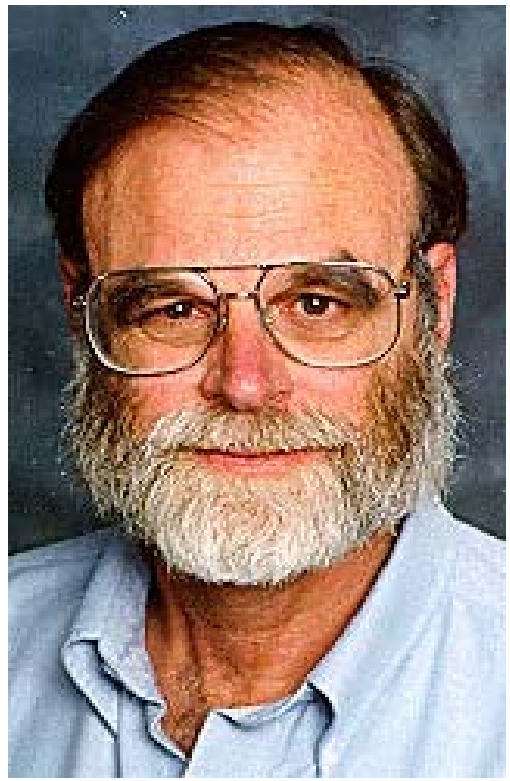
- Relational system (1980s)
  - Introduced in 1969-1970
  - data representation are table
  - operator generate new tables from old tables
  - Products : DB2, Ingres, Informix, SQL server, Oracle, Sybase, etc.
- Tunning Prize
  - Bachman (network DB) in 1973
  - E.F.Codd (Relational DB) in 1981
  - Jim Gray (Transaction) in 1998

Three Tunning Prize Person

C.W.Bachman



E.F.Codd



Jim Gray

Data Base Systems-cont.

- Object system
  - GemStone / Vansant ODBMS
  - Object relational system
- Multi-dimensional Approach
- Logical-based Approach
- XML Approach

Chapter2 Architecture

Contents

- Introduction
- The three level of the architecture
- DBA
- DBMS
- C/S architecture
- Utilities
- Data Access processing

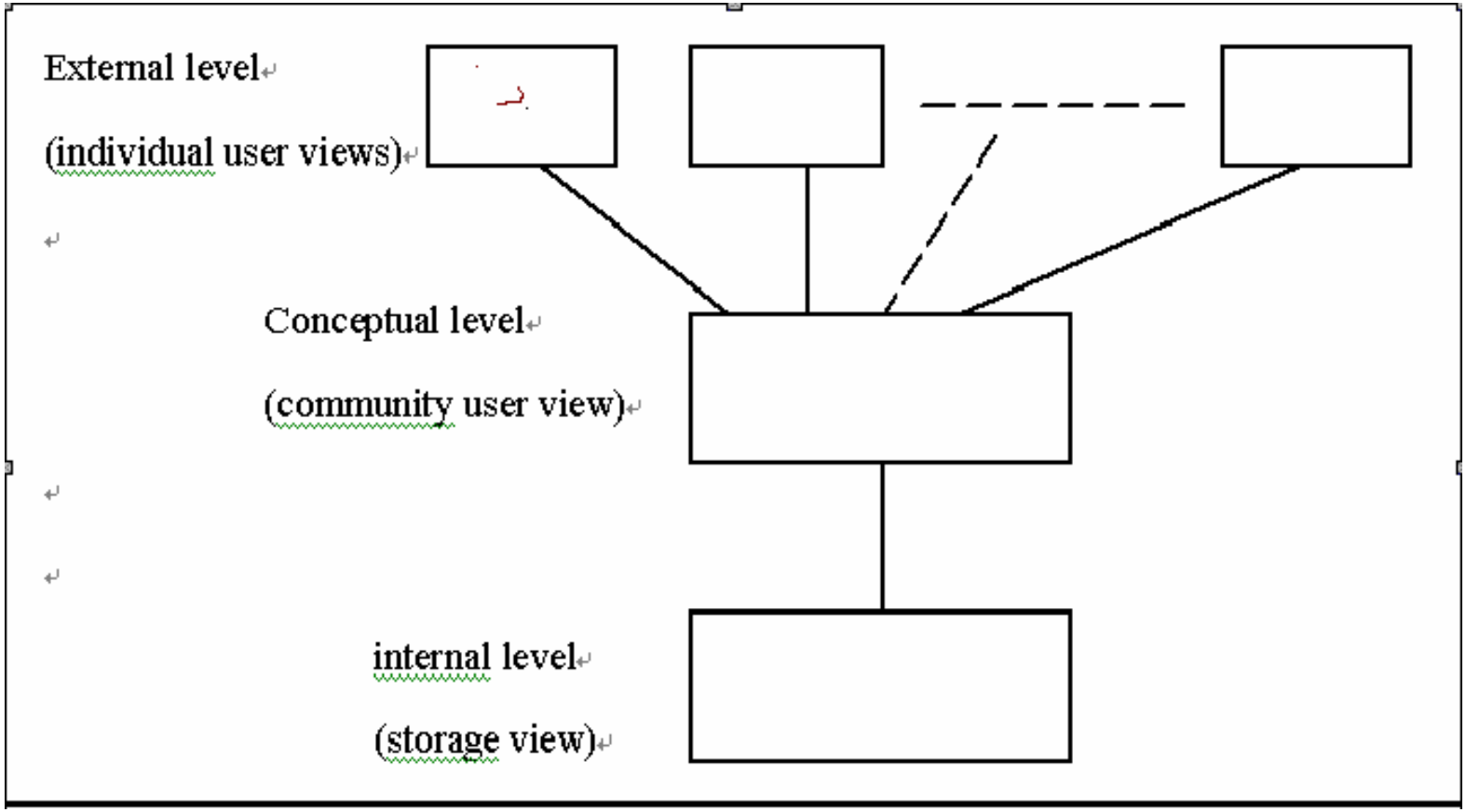
Introduction

- ANSI/SPARC

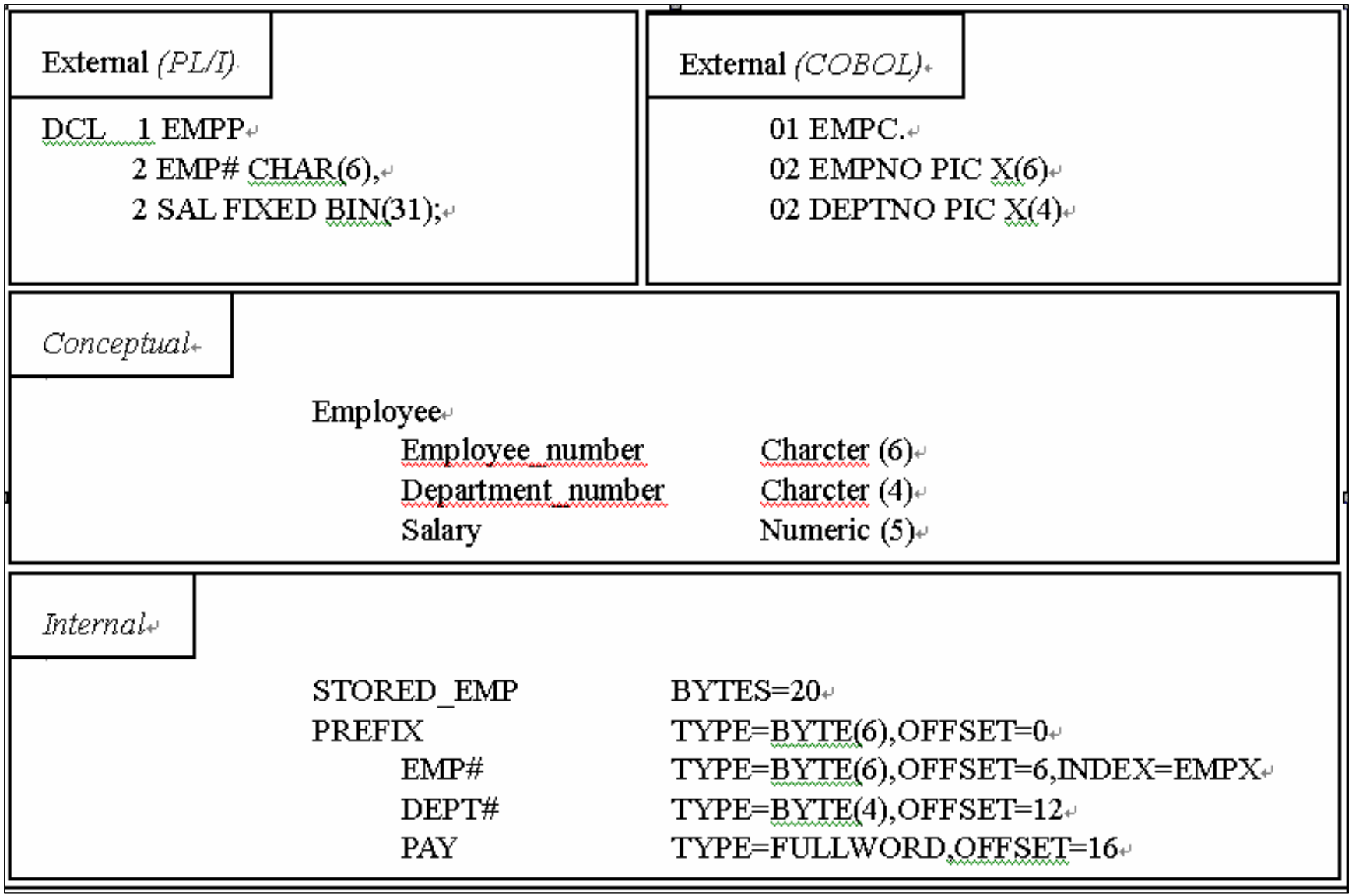
  Study Group on Data Base Management Systems

- Before
  - DBTG Report for network model in 1974

The three levels of the architecture



Example of the three levels



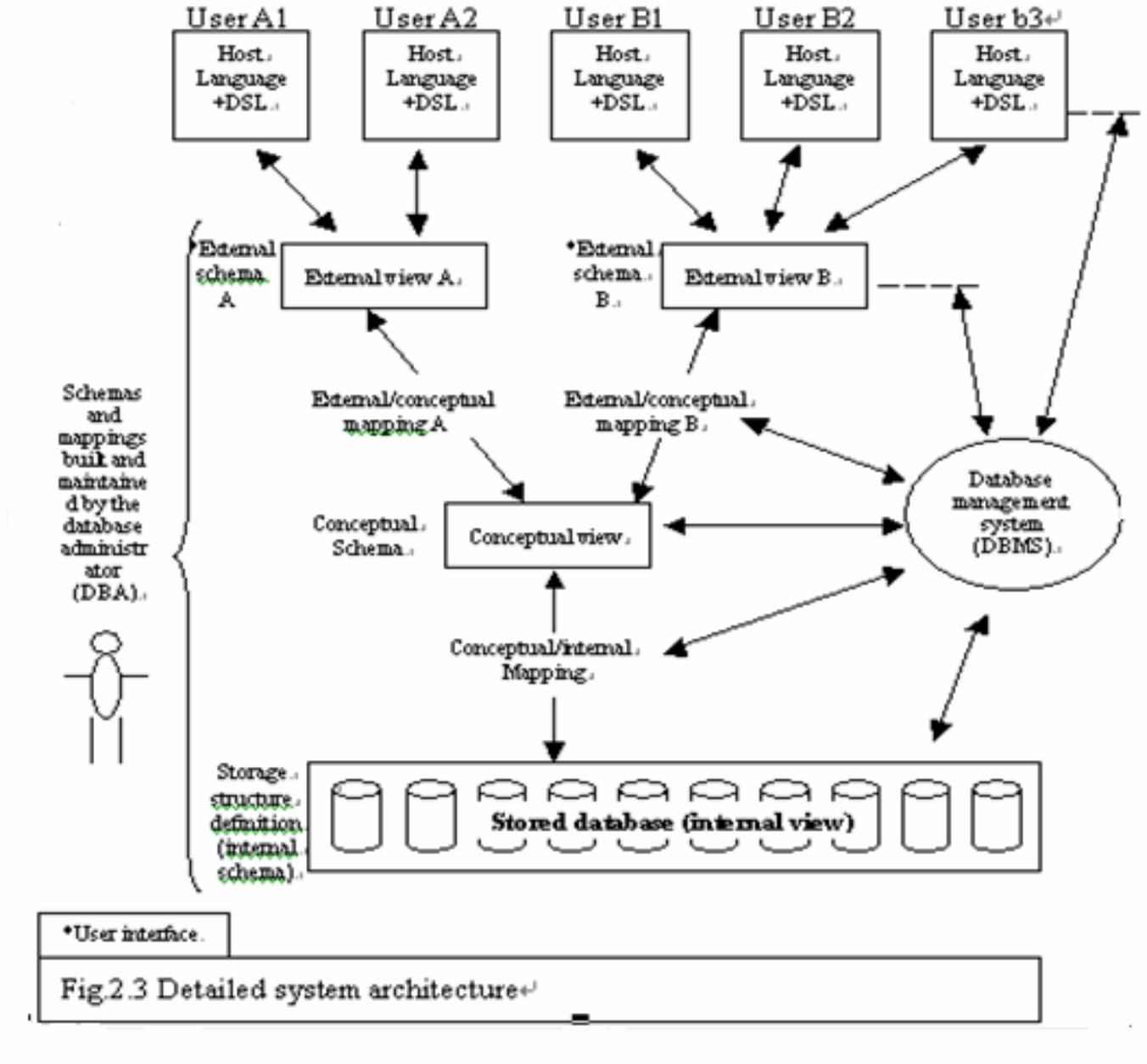


Fig.2.3 Detailed system architecture

External Level

- Individual level
- Each User has a language at his or her disposal (C++, Java …)
- Host language & Sub-Language

  Host language – C++, Java…

  Sub-Language – DDL, DML

  tightly coupled , loosely coupled
- External Record & External Schema

Conceptual Level

- Conceptual View

  a representation of the entire information content of the Database

- Conceptual Schema

  definition of the conceptual view

  it include security and integrity constraints

Internal Level

- Internal View

  a low-level representation of the entire database

  it doesn't deal in term of physical record (block or page), nor with any device-specific considerations.

- Internal Schema

  definition of the internal view

MAPPING

- Conceptual/Internal mapping

  the key to physical data independence

- External/Conceptual mapping

  the key to logical data independence

DBA

- Coordinates all the activities of the database system
- the database administrator has a good understanding of the enterprise’s information resources and needs.

DBA – Cont.

- Database administrator's duties :
  - Schema definition (Logical Database Design)
  - Storage structure and access method definition
  - Schema and physical organization modification
  - Granting user authority to access the database

DBA – Cont.

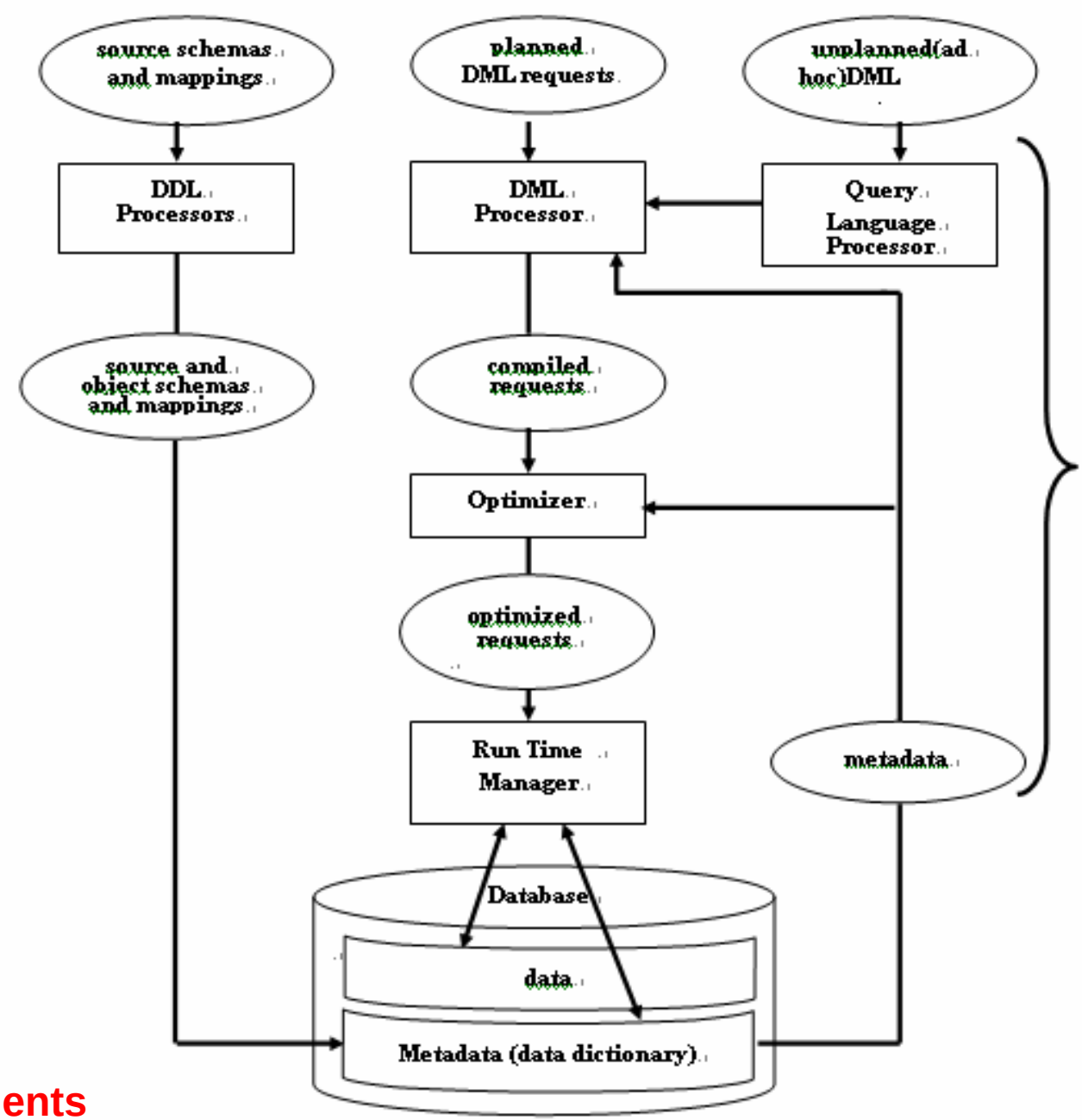
- Specifying integrity constraints
- Acting as liaison with users
- Defining dump & reload policies
- Monitoring performance and responding to changes in requirements

DBMS

- Software - handles all access to the Database
  - Data definition
  - Data manipulation
  - DML request (planned/unplanned)

DBMS-cont.

- Optimization & execution
- Data security & integrity
- Data recovery & concurrency
- Data dictionary
- Performance



DBMS Components

DBMS - Cont.

- File management system
  - not aware internal structure of stored record
  - little or not security & integrity support
  - little or not recovery & concurrency control
  - no true dictionary
  - less data independence
  - not integrated or shared

C/S Architecture

- Server

  DBMS itself

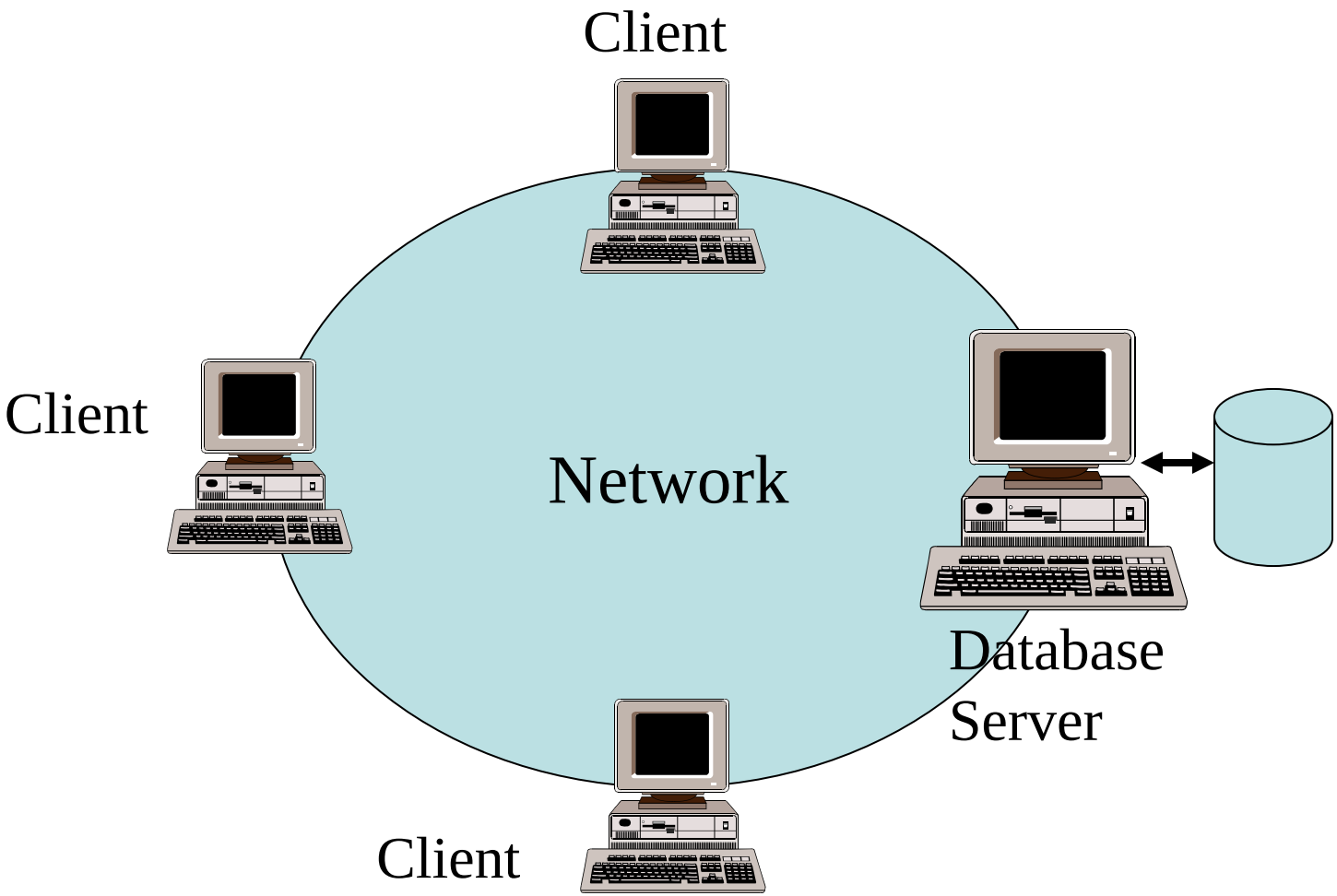
- Client

  various applications that run on top of the DBMS

- User - written application
- Vendor - Provided application (tools)

  Report writer, Spreadsheet, Statistical package….

C/S Architecture



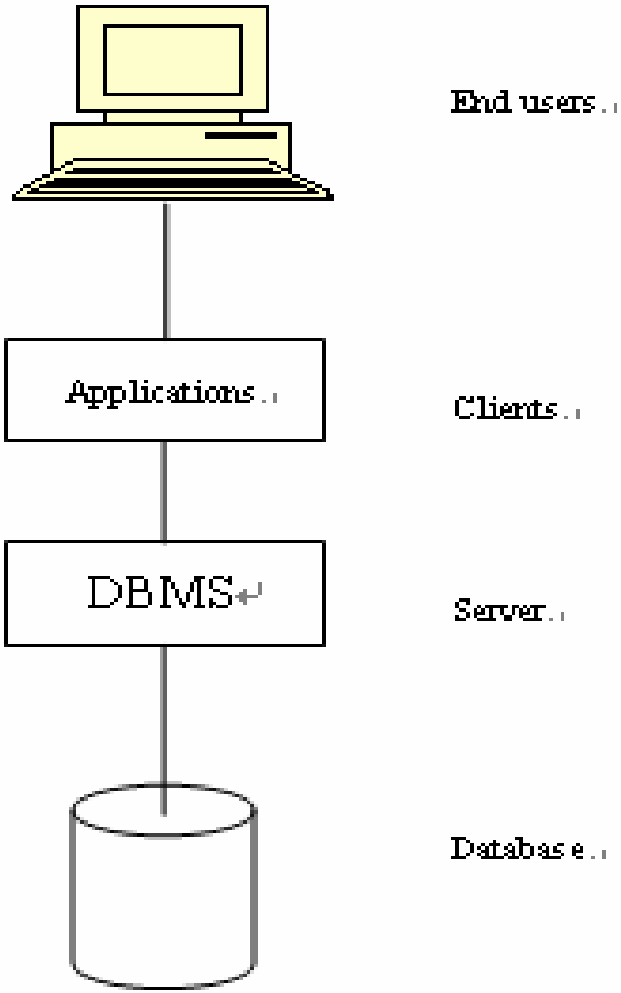


Fig. 2.5 Client/server architecture

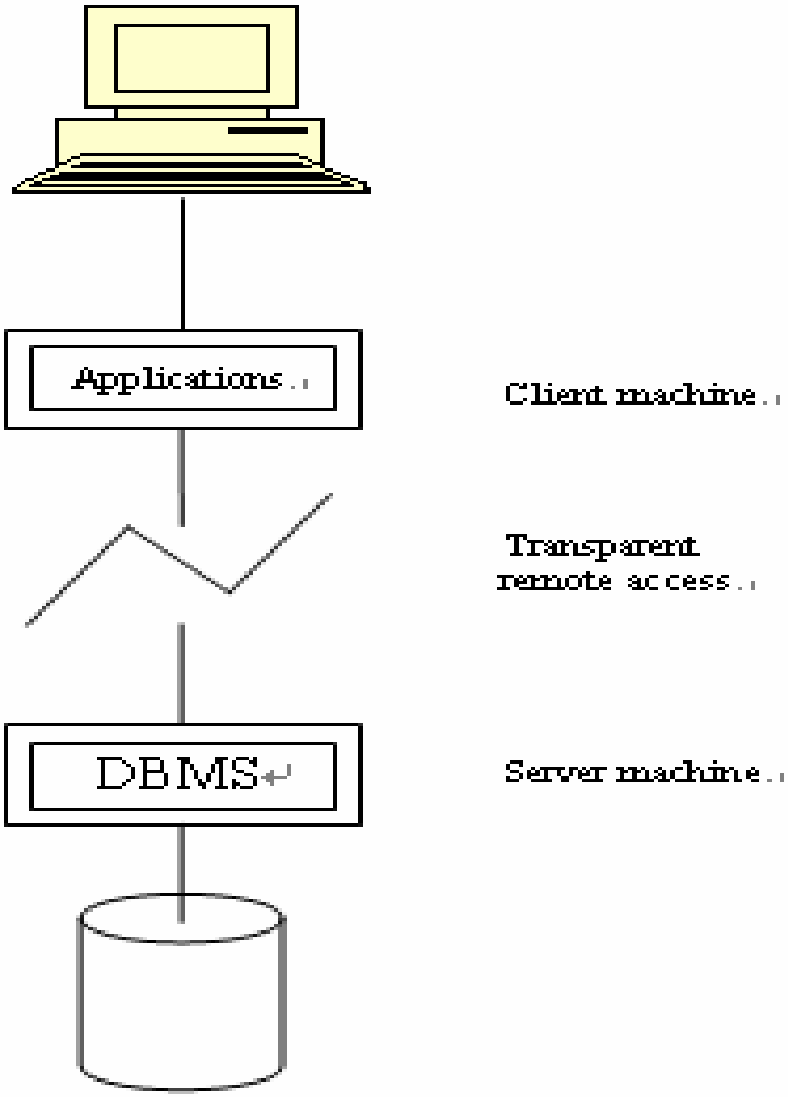


Fig.2.6 Client(s) and server running on different machines

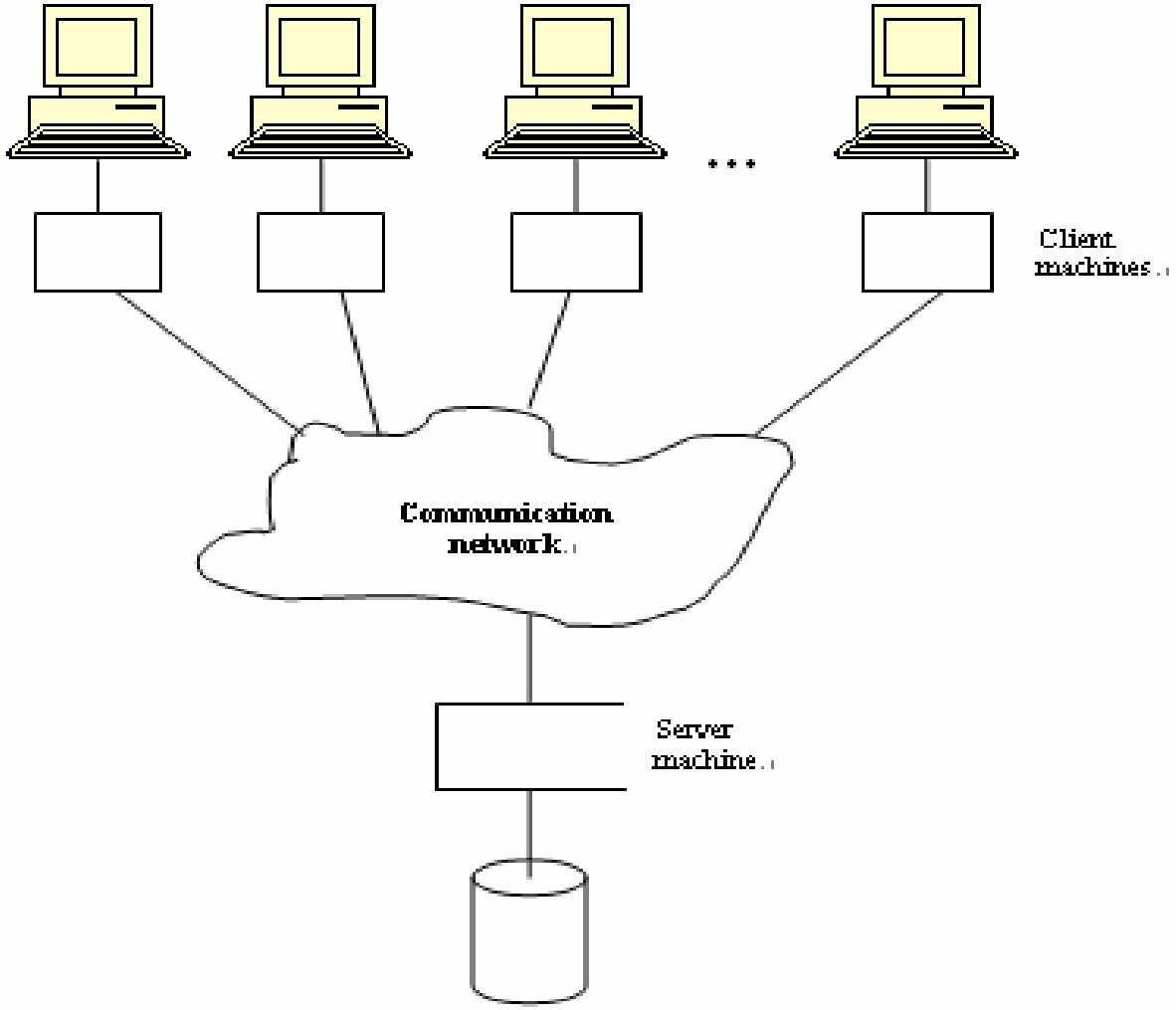


Fig. 2.7 One server machine, many client machines

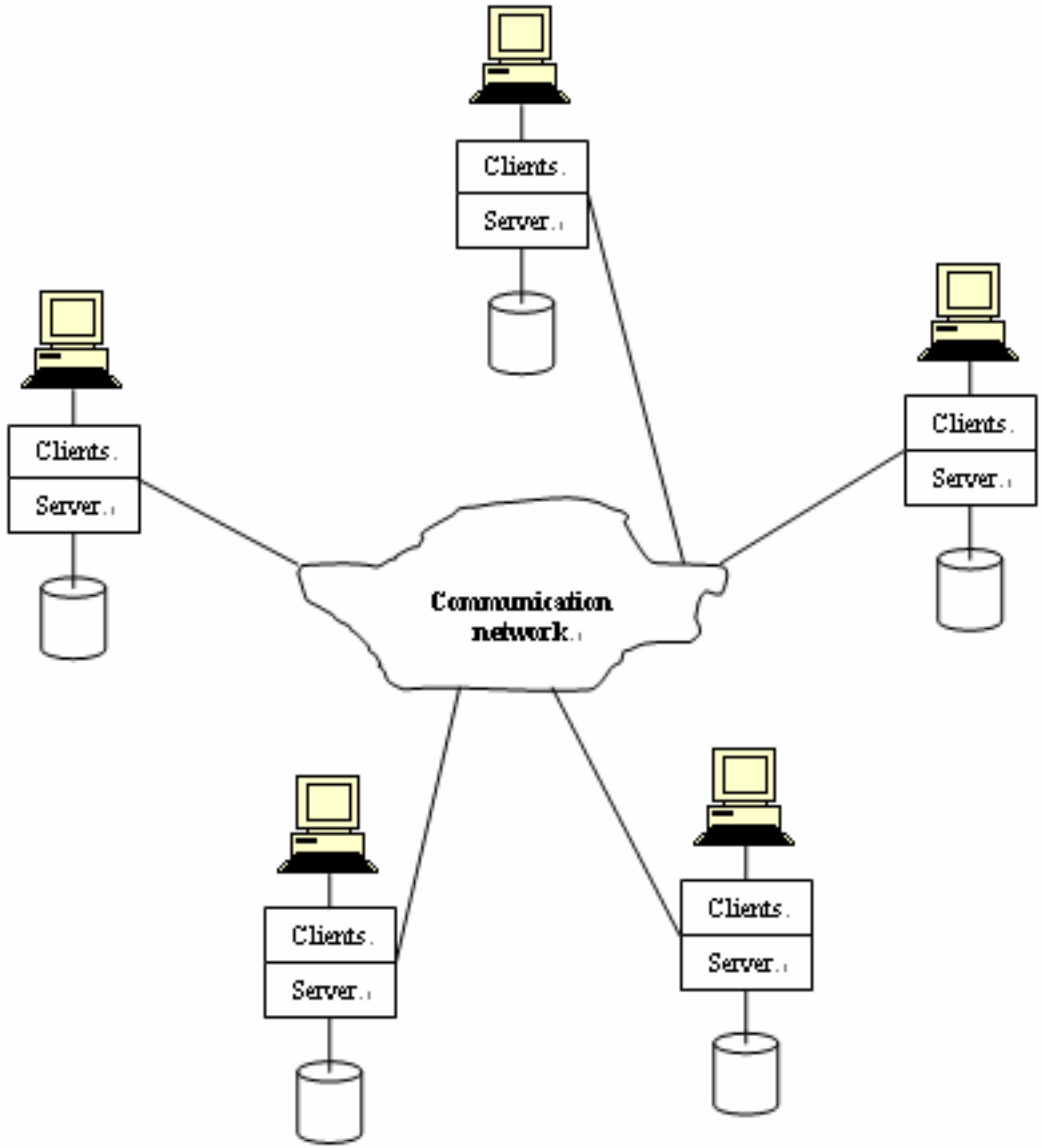
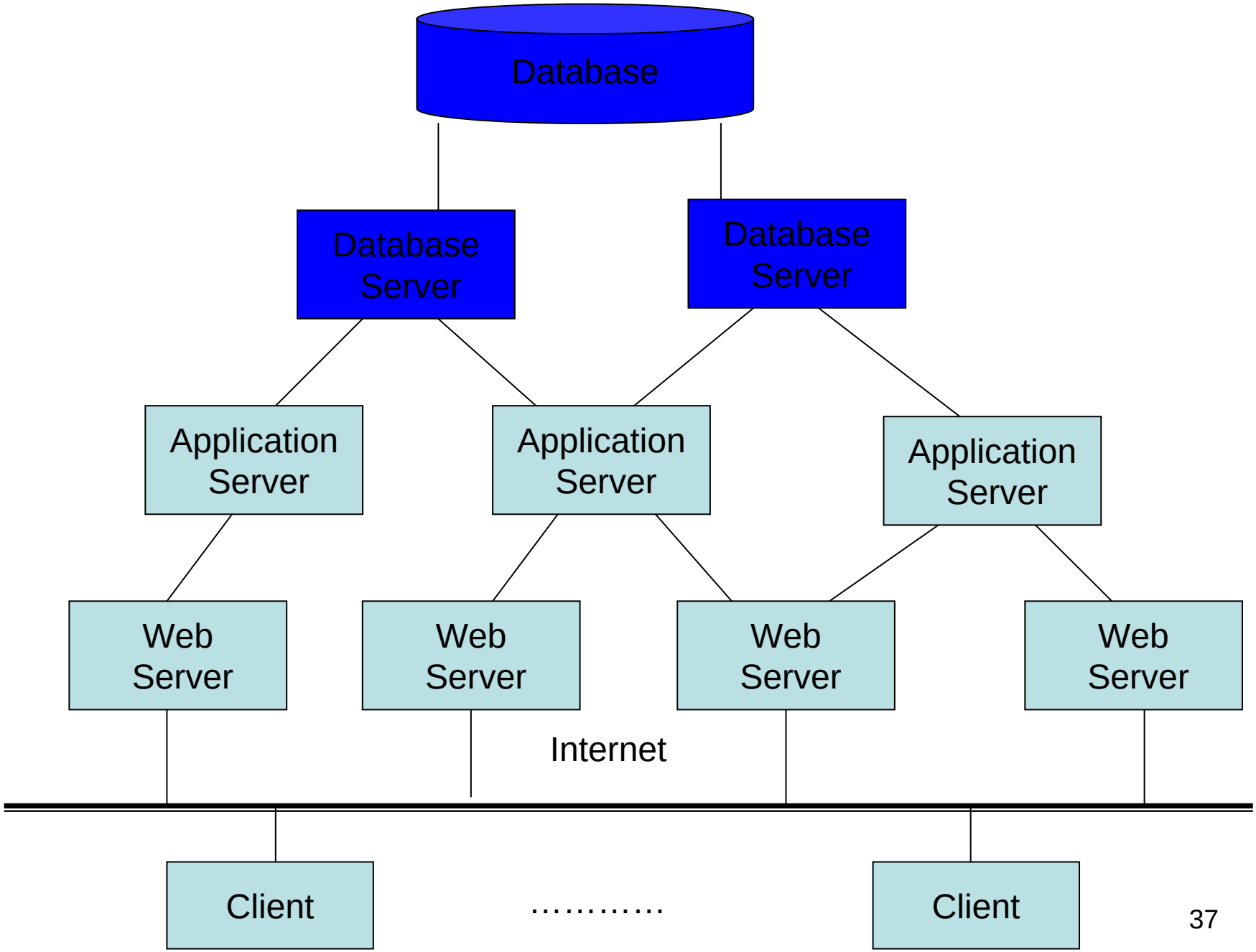


Fig. 2.8 Each machine runs both client(s) and server

B/S Architecture

- Three-Tier Architecture
  - Web Server
    - Connect client to the database system, usually over the Internet or possibly a local connection
  - Application Server
    - Perform the “business logical”, whatever it is the system is intended to do
  - Database Server
    - Run the DBMS and perform queries and modifications at the request of the application server


Database
Database Server
Database Server
Application Server
Application Server
Application Server
Web Server
Web Server
Web Server
Web Server
Internet
Client
……
Client

Utilities

- load
- Unload/reload
- reorganization
- Statistics
- Analysis

Data Acess process

- Issue a read request from program
- DBMS intercept and analyze it
- DBMS access three level schemas and two mappings from Dictionary
- DBMS issue disk read request to OS
- OS issue read to disk and fetch correspond pages to buffer
- the Data passed to user work-space under DBMS
- DBMS return a state word to program

- Exercise

  2.4, 2.5, 2.6