Distributed computing systems

Client-Server Model

CLIENT-SERVER INTERACTION

Problem: centralization VS decentralization

- This is one of the oldest problems in IT
- Example:
  - *King J.L. Centralized versus decentralized computing: organizational considerations and management options//ACM Computing Surveys. Vol. 15, Issue 4. 1983. (P). 319-349.*

Prior to the 70's: the centralized model

- Until the mid 70-ies of the last century - centralized model:
  - The high cost of telecommunications equipment
  - Low power computing systems

80 's – 90 's: mainframes

- The emergence of time Division systems and remote terminals - the premise of client-server architecture.
- Mainframe resources were provided to end users through a remote connection.
- Further development of telecommunication systems and the advent of personal computers gave impulse to the development of client-server paradigm of data processing

Client-server architecture

- According to the paradigm of client-server architecture:
  - one or more clients and one or more servers
  - together with the base operating system
  - and environment interactions
  - form a single system providing distributed computing and data analysis

Application of Clent-server model

- The process of development of distributed application is complex and one of the most important tasks is to decide
  - *how to divide the application functionality between the client and the server.*

Levels of client-server architecture

Levels of client-server architecture

- Today they highlight 3 main levels of client-server architecture:
  - The presentation tier (the user interface)
  - The business logic tier (processing)
  - The data tier

The presentation trier

- Typically implemented on clients
- Provides methods for interaction with your application
- The simplest option:
  - character display (Terminal) to the mainframe

The business logic tier

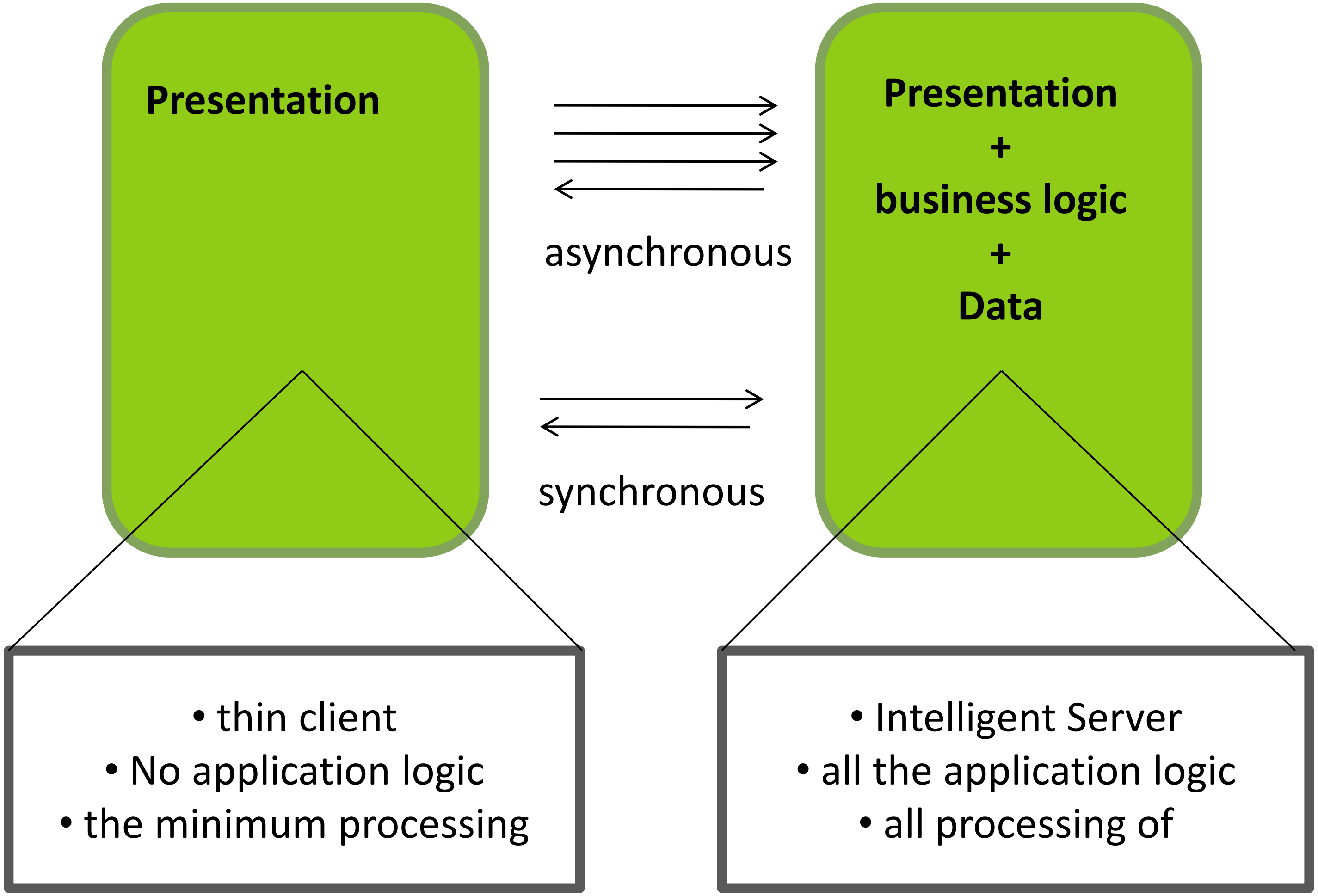
- Business logic is a set of rules, principles and dependencies of behavior of domain objects.
- Synonym: Domain Logic.
- Example:
  - the formula for the calculation of the salary + taxes;
  - evaluation of quality of education based on student evaluations;
  - rejection of the hotel upon race cancellation by the airline.

The data tier

- Applications that provide data processing
- Data PRESERVATION requirement: when the application is closed, the data must remain in a particular place;
- the requirement of INTEGRITY: metadata (descriptions of tables, constraints, and so on) should be checked for this level
- Typically implemented by relational database

History and types of client-server architecture

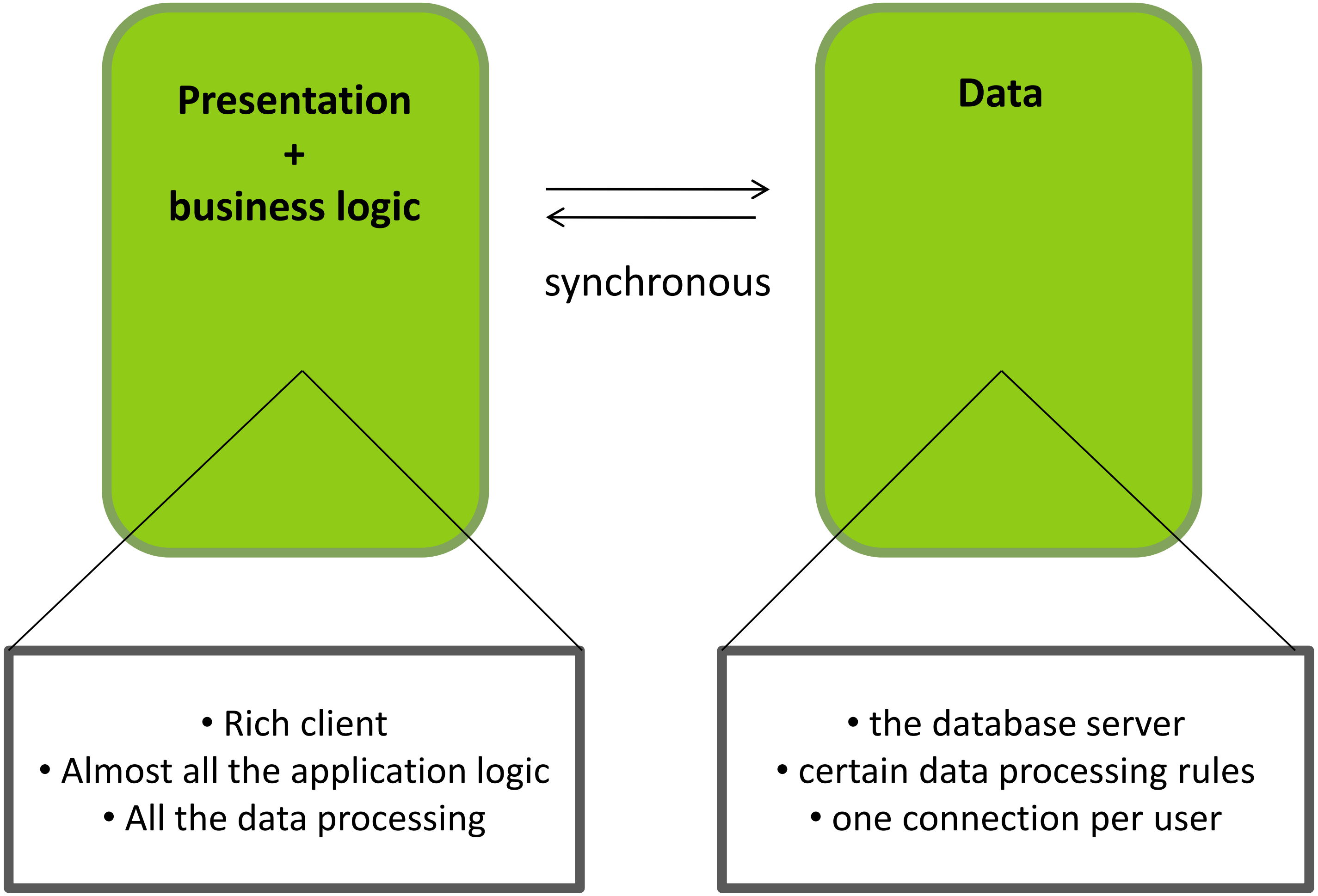
One-tier architecture



- thin client
- No application logic
- the minimum processing

- Intelligent Server
- all the application logic
- all processing of

Two-tier architecture



Presentation
+
business logic

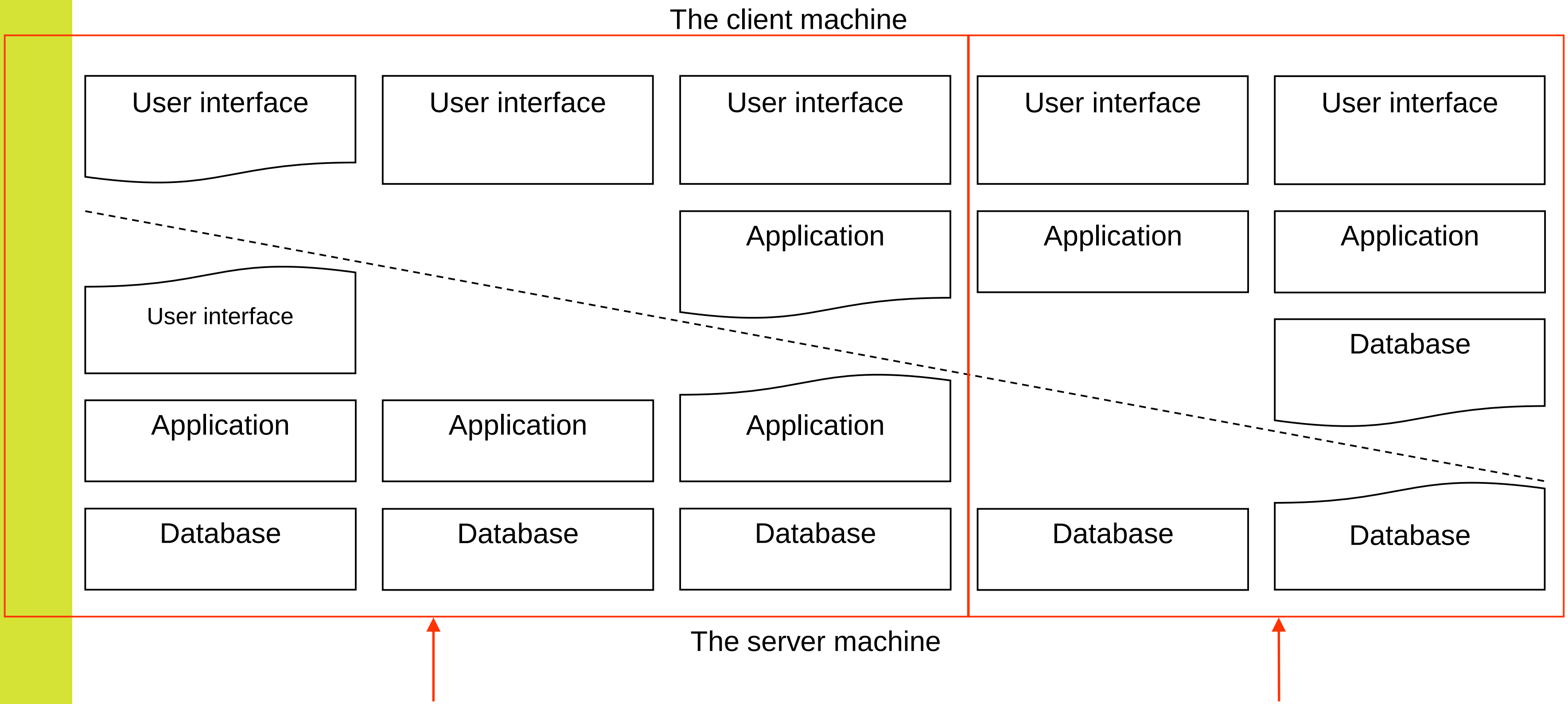
synchronous

Data

- Rich client
- Almost all the application logic
- All the data processing

- the database server
- certain data processing rules
- one connection per user

Alternative options of two-tier architecture



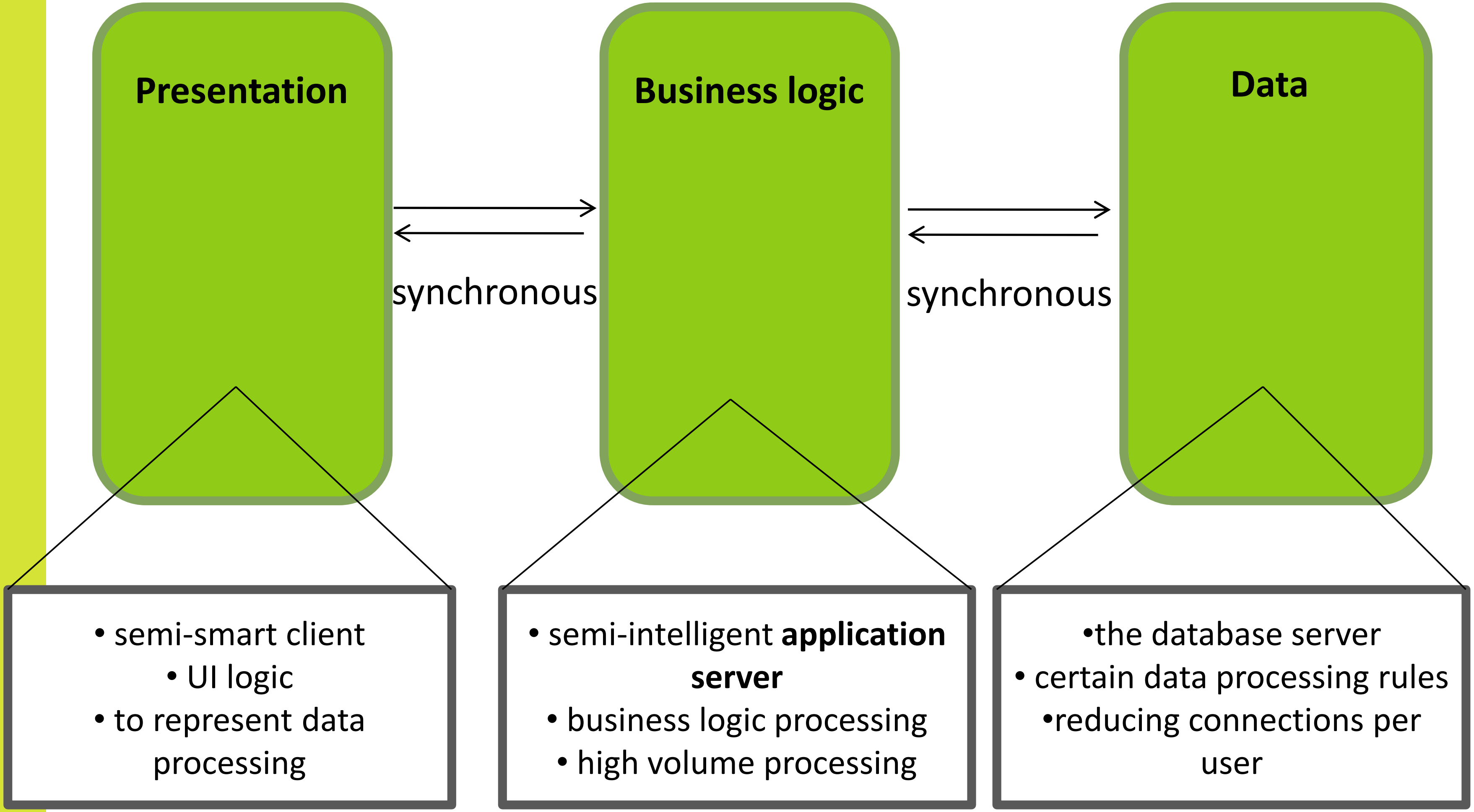
Thin client

Rich client

Cons of two-tier architecture

- Extraordinary expenses for maintenance of workstations that need to handle the business logic
- Difficult to update applications when business logic changes (all clients must be reinstalled)
- Each workstation is a unique set of software which may conflict with the client and influence on it's work

Three-tier architecture

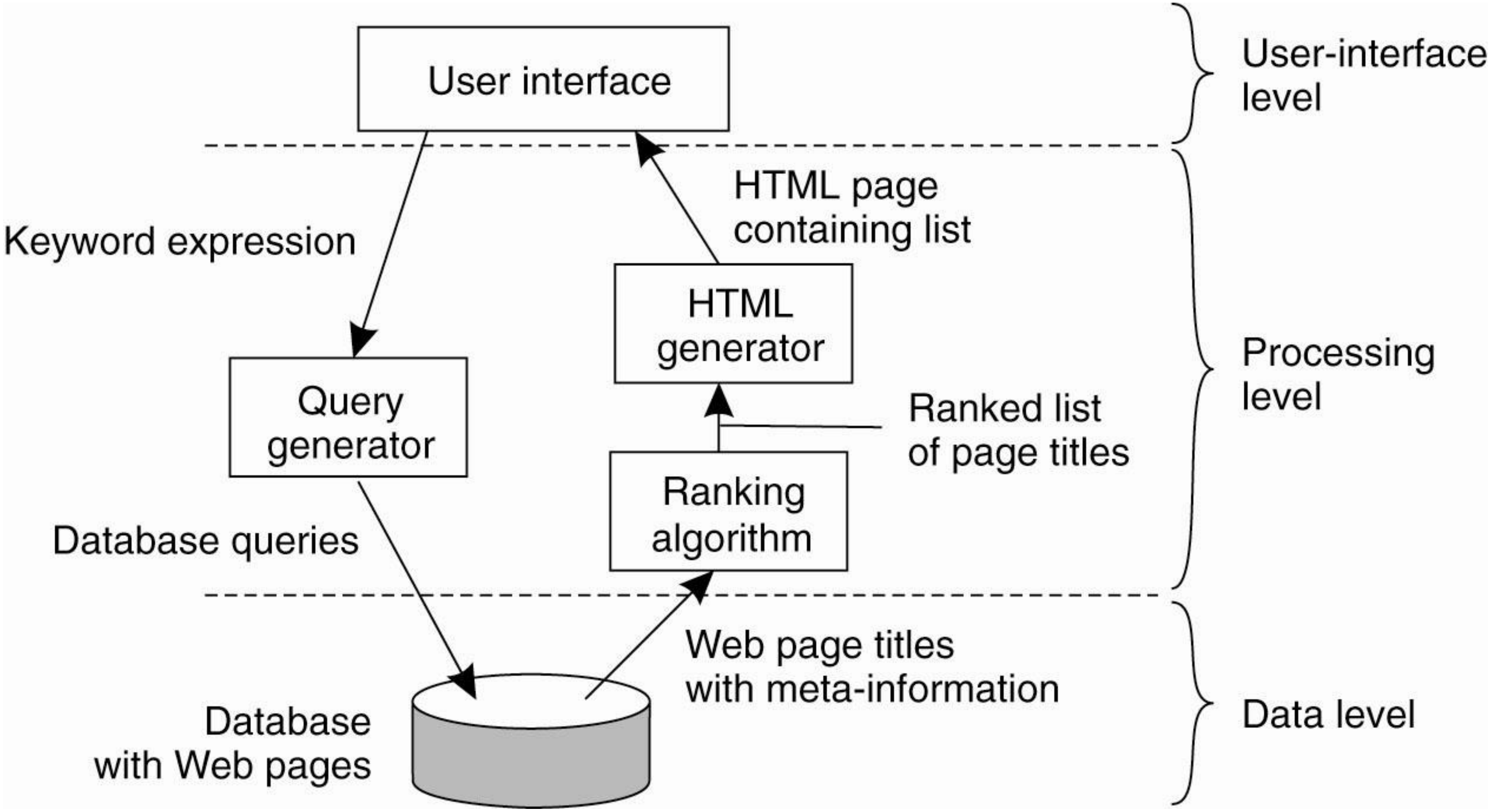


- semi-smart client
- UI logic
- to represent data processing

- semi-intelligent **application server**
- business logic processing
- high volume processing

- the database server
- certain data processing rules
- reducing connections per user

Application Layering



The simplified organization of an Internet search engine into three different layers.

A modern example of multi-tier architectures

- 1. Client browser->
  - 2. IIS->
    - 3. ASP.NET 2.0 runtime->
      - 4. ADO.NET 2.0 data provider->
        - 5. MySQL Server->
      - 6. ADO.NET 2.0 data provider->
    - 7. ASP.NET 2.0 runtime->
  - 8. IIS->
- 9. Client browser

Summary

- There are 3 tiers in client-server architecture:
  - The presentation tier (the user interface)
  - The business logic tier (processing)
  - The data tier