Chapter2 The database development process

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Outline

- Database development within information system development
- Database development process
- Alternative information system development approaches
- Three-schema architecture for database development
- Three-tired database location architecture

Database development within information system development

- Enterprise data modeling
- Information engineering
- Information system planning

Enterprise data modeling

- The first step in database development
- The scope and general content of organizational databases are specified
- Overall picture or explanation of organizational data
- A very high level of abstraction, not the design for a particular database

Information engineering

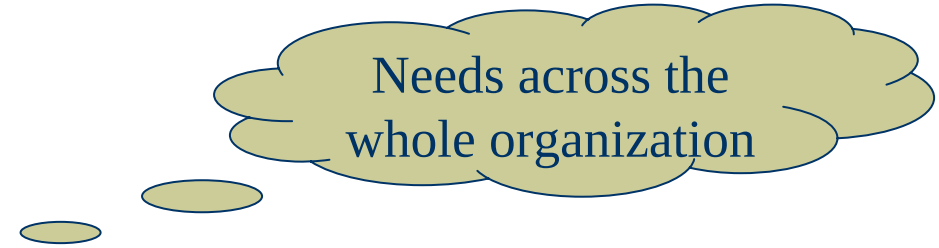
- What is information engineering?

  A **data-oriented** methodology to create and maintain information systems

- Approach:

  top-down planning:

  - A broad understanding of information needs → specific information systems



- Steps:

  planning, analysis, design, implementation

Information system planning (1)

- **Align information technology with the business strategies of the organization (requirements)**

- Identifying strategic planning factors

① goals: maintain 10% per year growth rate

② critical success factors: high-quality product

③ problem areas: inaccurate sale forecasts

Purpose:
Link information system plans to the strategic business plans

- Identifying corporate planning objects

① organizational units: various departments

② organizational locations: places

③ business functions: business processes

④ entity types: major categories of data

⑤ information systems: applications, procedures

Purpose:
Define the business scope

Information system planning (2)

- **Develop an enterprise model**

① functional decomposition (breakdown the functions)

② **entity-relationship diagram**

③ planning matrixes (interrelationships between planning objects)

	Department	student	course	teacher
Enter	×	×		
Enroll		×	×	×
Arrange	×		×	×
Aggregate	×	×	×	×

Function-to-data entity matrix

Other matrixes …

Database development process

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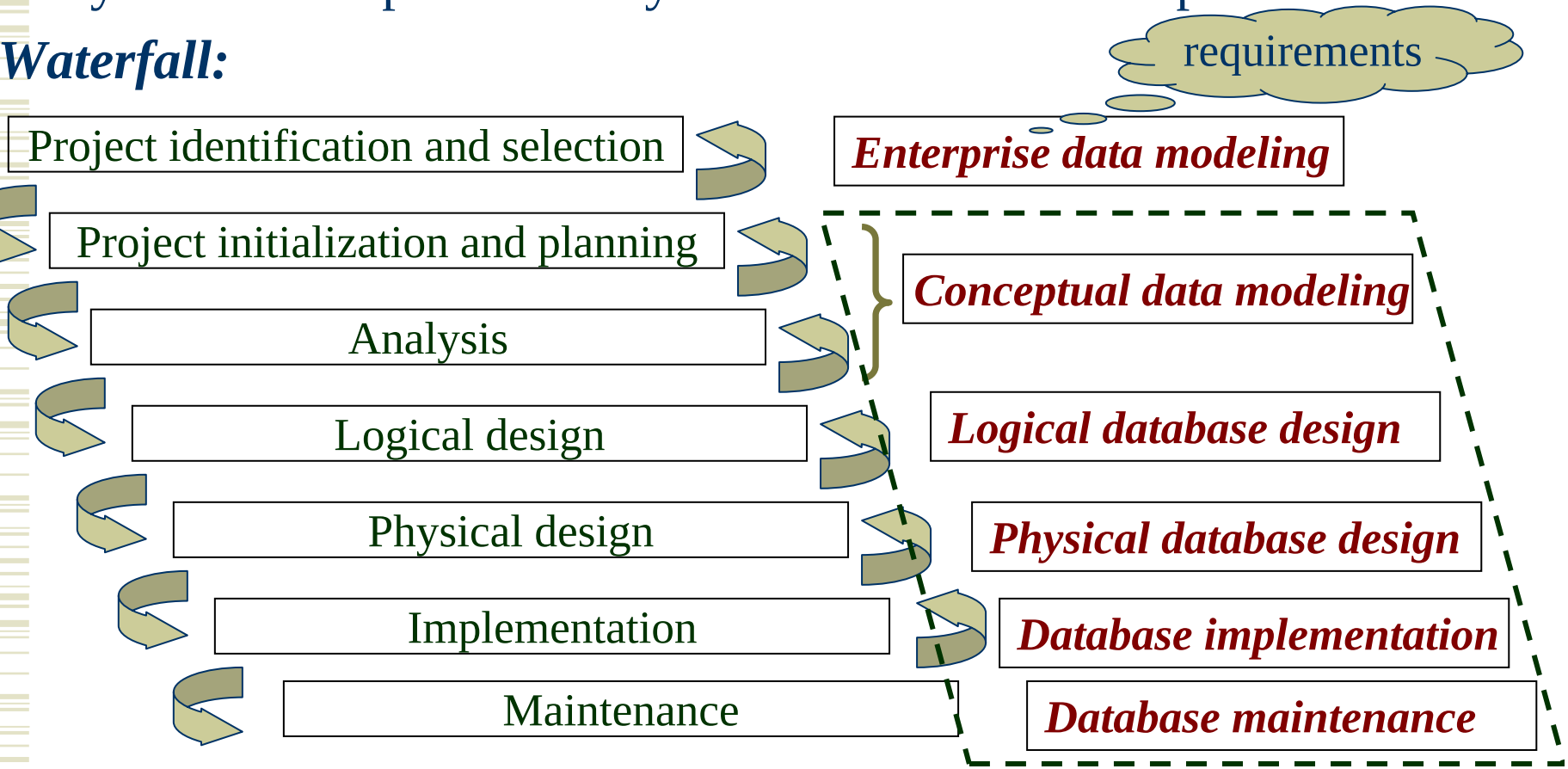
Database development process (Information system development)

- System development life cycle vs. database development activities

Waterfall:



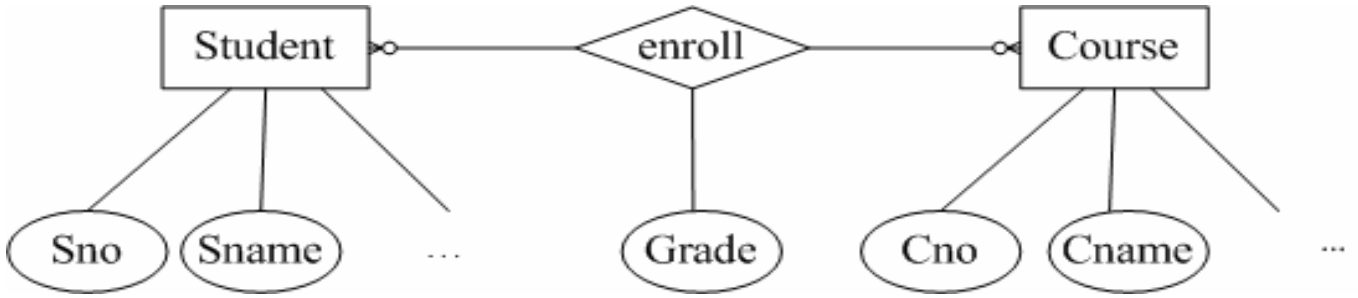
The database development process

Conceptual data modeling

- Analyze overall data requirements
- Develop conceptual data model including entities and relationships
- Top-down fashion: derived from the generalization of the data and relationships themselves, rather than the particular applications

Logical database design

- Transform the conceptual data model into ***relations***
- Identify the thorough view of the database, transactions, reports, etc.
- Create a ***stable*** and ***well-defined structures*** of the database



3 tables:

① Student(Sno, Sname, …);
② Course(Cno, Cname,…);
③ Enroll(Sno, Cno, Grade)

- relational tables
- keys and foreign keys
- reports and transactions
- … …

Physical database design and implementation

- **Physical database design**
  - Decide on physical organization of data
  - Efficiency and security strategies
  - Optimizations and some improvement on the design based on the user requests
- **Implementation**
  - Code and test database processing programs, SQL based programs
  - install database and convert data from prior systems by ***a neutral format***

What's your opinion about the neutral format?

Alternative information system development approaches

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Alternative *IS* development approaches (1)

- **Motivation**

- SDLC is a highly structured method
- SDLC has Long time for development, and is not easy to check whether the needs are satisfied timely

- **Rapid application development (RAD)**

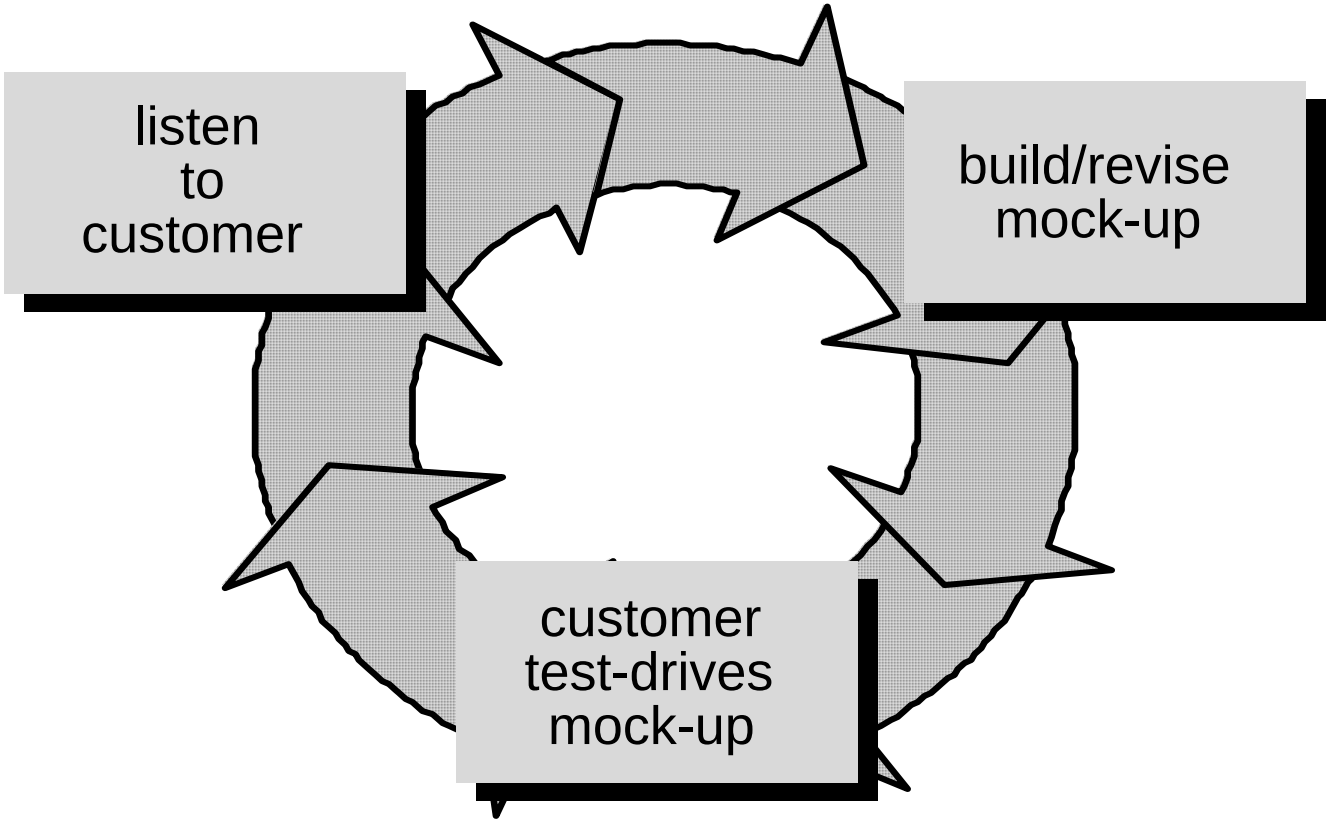
- an iterative process of rapidly repeating analysis, design, and implementation steps until the needs are converged, …
- **Prototype method**

① An iterative process of system development in which requirements are converted to a working system that is **continually revised through close work between analysts and users**

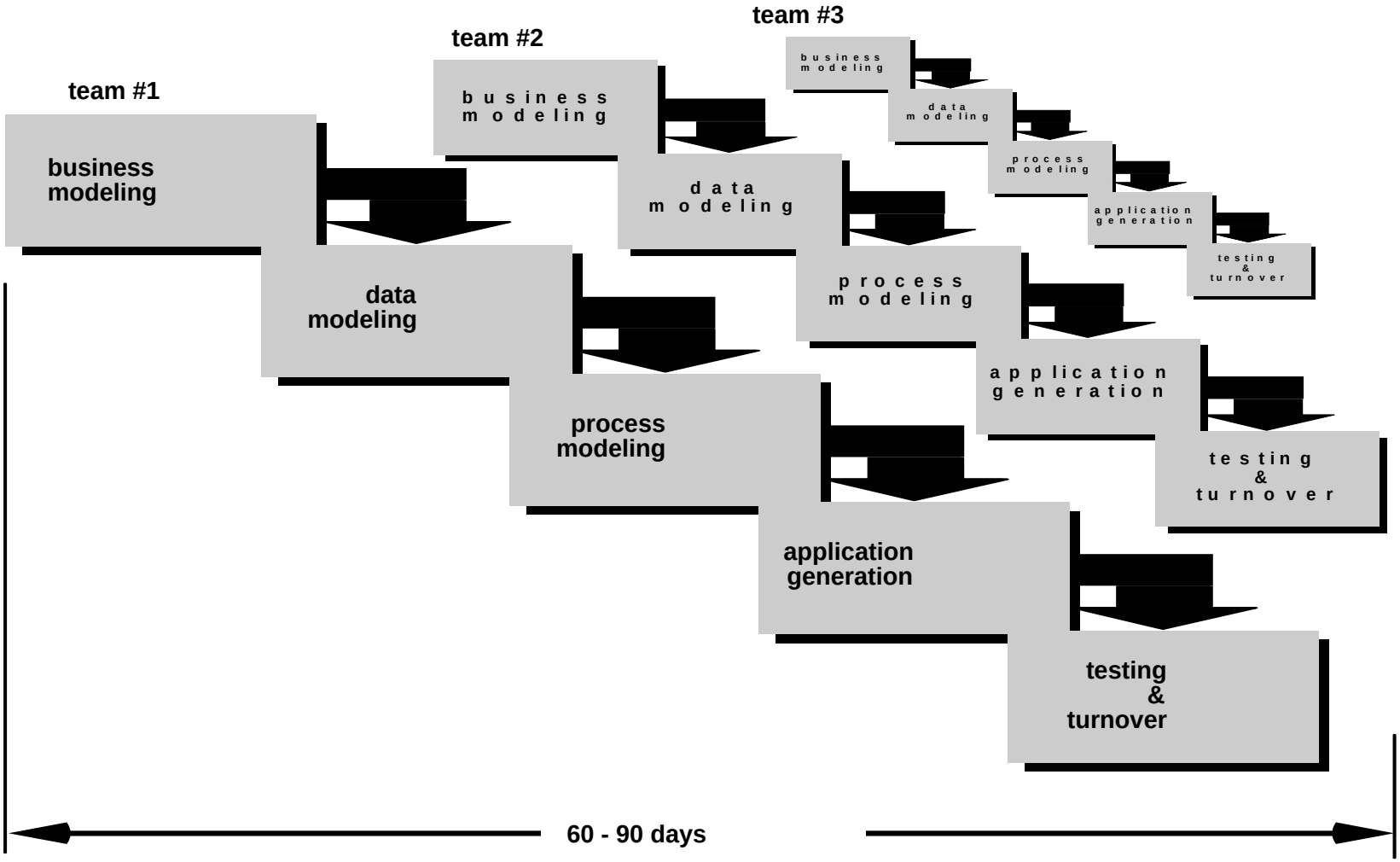
② Simultaneously designs the displays and reports that the user wants

③ New versions of the prototype are produced; repeat database implementation and maintenance activities

Alternative *IS* development approaches (2)



Alternative *IS* development approaches (3)



Discussion on Prototype method

- **Whether is it suitable for all cases?**
- **What are the benefits?**

***Suited cases*:**

- when database application is ***small and stand-alone***
- ***a small number of users*** exist

***Benefits and feasibility*:**

- relatively easy to change the contents and layout of user reports and displays
- easy to modify the interface between user and program (4GL)
- Sample data used to rebuild the database prototype

Any other RAD methods?

Case tools; repository; …

Three-schema architecture for database development

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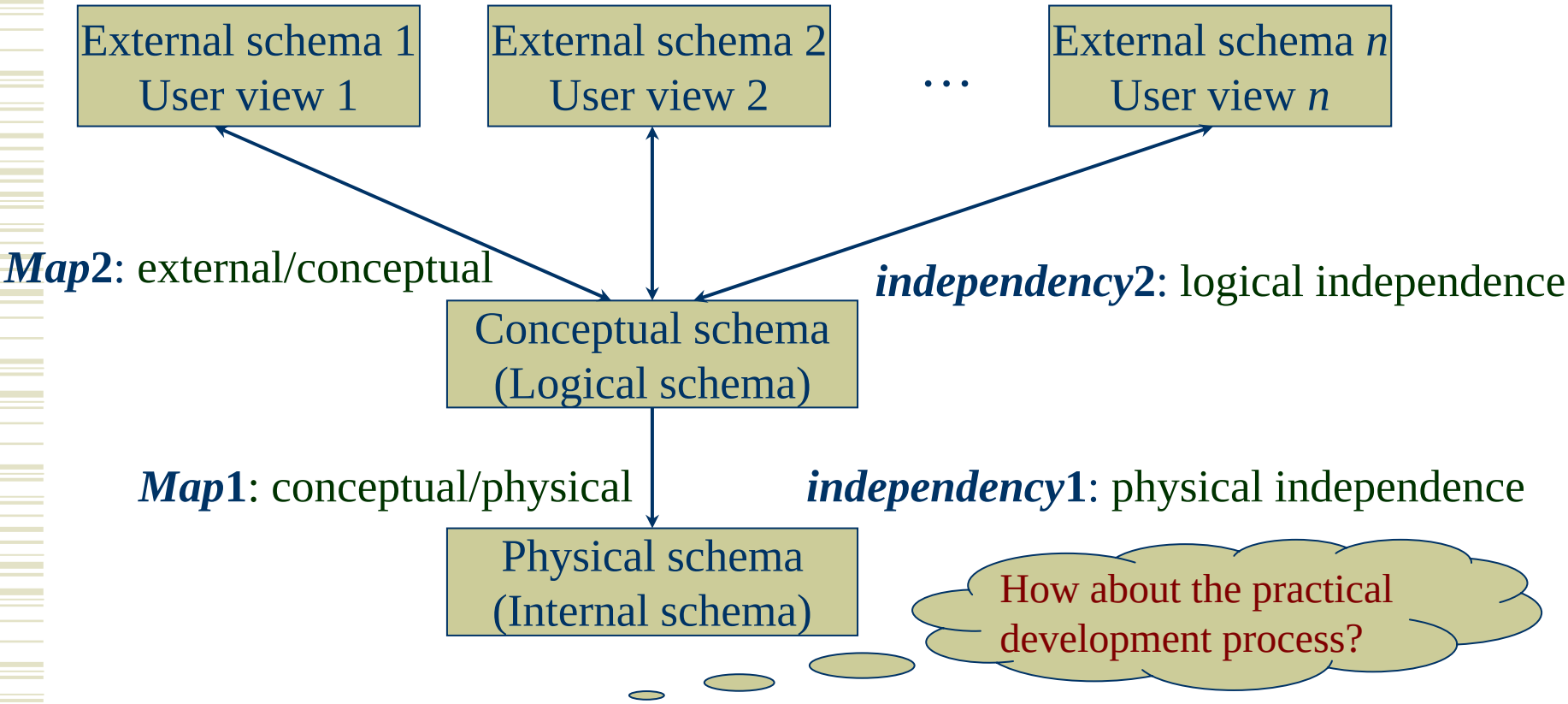
Three-schema architecture for database development (1)

3 schemas and 2 maps:



Three-schema architecture for database development (2)

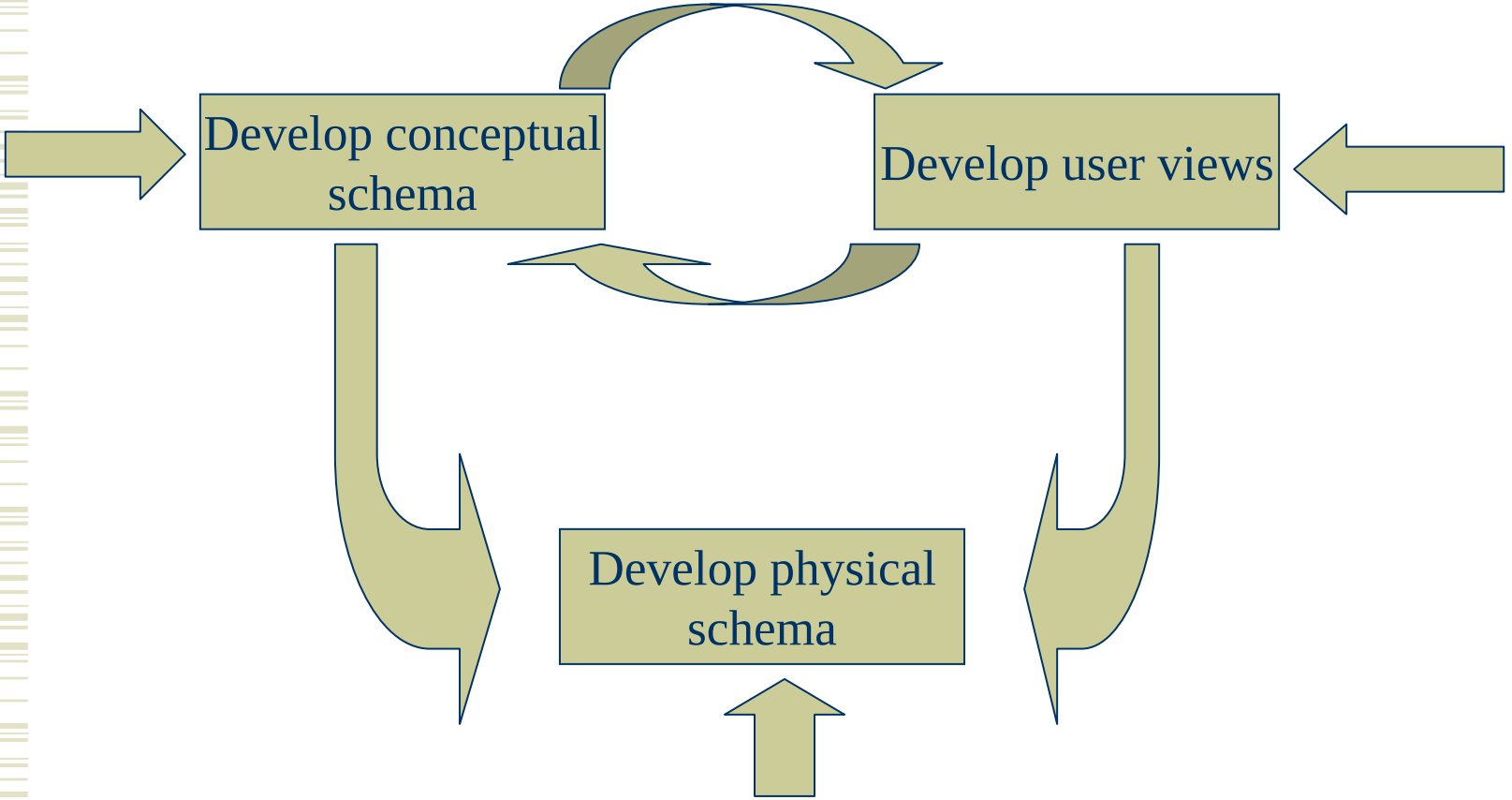
- **3 schema** (1 physical schema, 1 conceptual schema, and one or more external schemas):
  - **external schema(user view)**: local database view, including the definition of program report, display, transaction, and so on.
  - **Conceptual schema(logical schema)**: global database view.It is often represented in graphical format using E-R or object modeling notations.

  (Note: external and conceptual schemas are independent on the database technologies)
  - **Physical schema(internal schema, storage schema)**:

  How data from a conceptual schema are stored in a computer's secondary memory.
- **2 independencies:**
  - **Physical independence**: when the physical schema is changed, the conceptual schema will ***not*** be changed based on the ***conceptual/physical map***
  - **Logical independence**: when the conceptual schema is changed, the external schema will ***not*** be changed based on the ***external/conceptual map***

Three-schema architecture for database development (2)

- **Cycling back to the design steps (in practical applications):**



The database development process

Three-tired database location architecture

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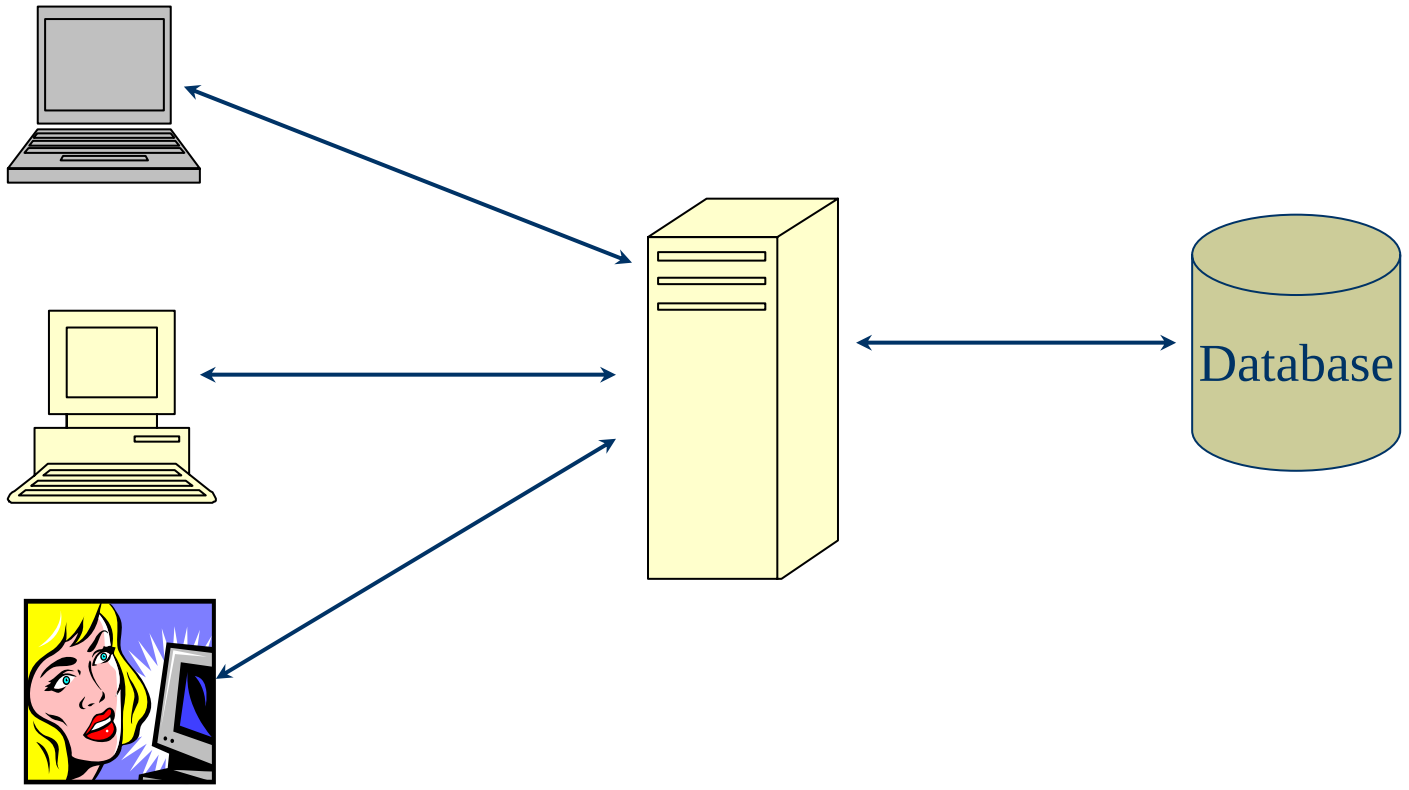
Three-tired client/server database architecture

client — application/Web server — database



Assignments

1. Describe the database development process.
2. Page 64: 12, 13.

PS:

12. Define the steps in the prototyping systems development process. Which database development activities occur in each prototyping steps?
13. Explain the differences between user views, a conceptual schema, and a physical schema as different views of the same database.

Summary

- **Information engineering**
- SDLC vs. **database development process**
- Rapid application development and **Prototype method**
- **Three-schema architecture** for database development
- Three-tired client/server database architecture

The end

Thanks!