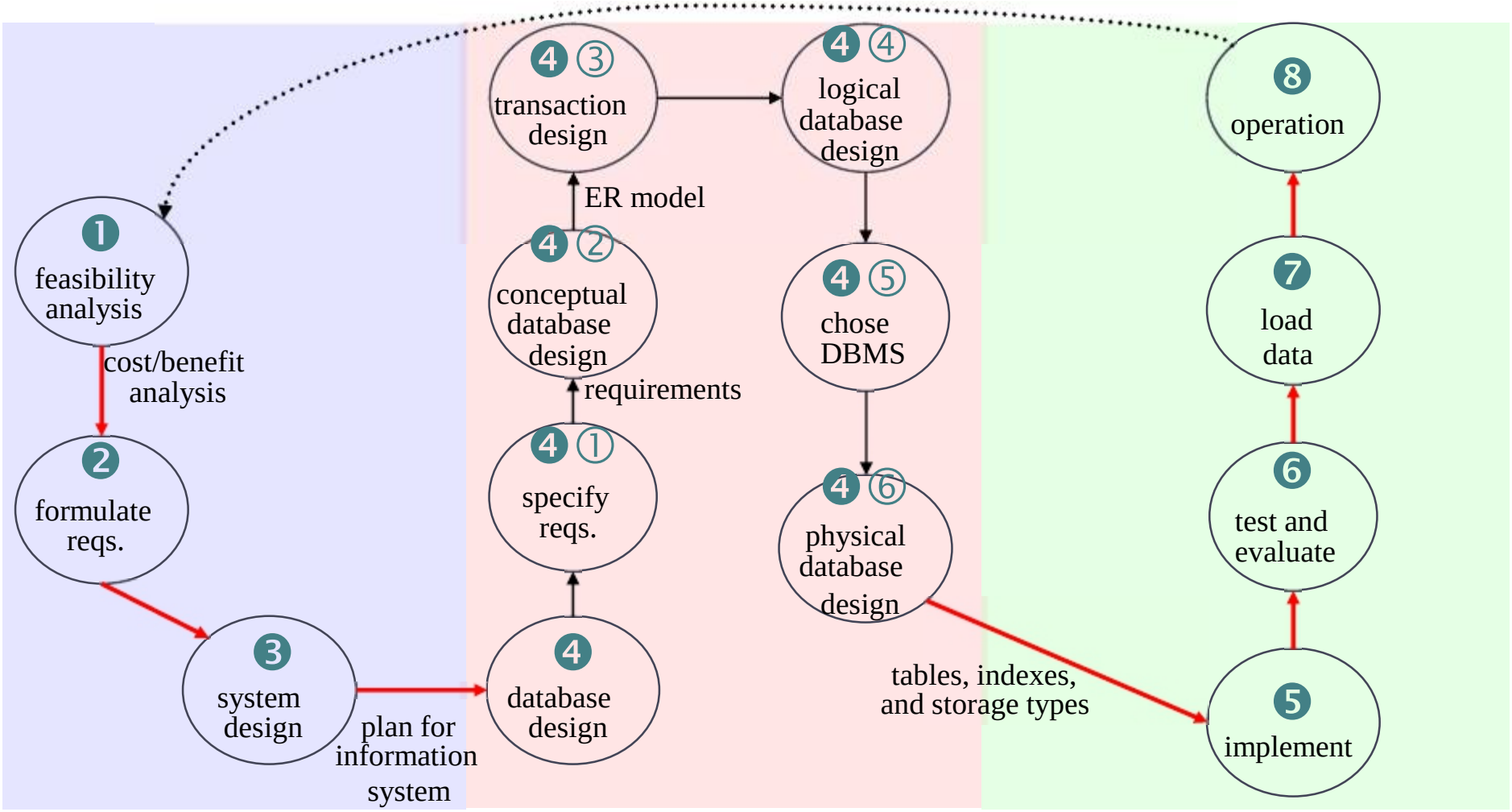
Topic
The Information System Lifecycle

Organizational Context of a Database System

- Businesses and organizations depend on database technology to provide:
  - Continuous operation
  - High availability
  - Up-to-date and correct information
  - Loss protection
  - Maintenance of complex interrelationships within the data
- Large database systems are components of even larger *information systems*.
  - Airline reservation systems
  - Computer-aided design and production tracking systems
  - Customer service systems in banks

Lifecycle of an Information System

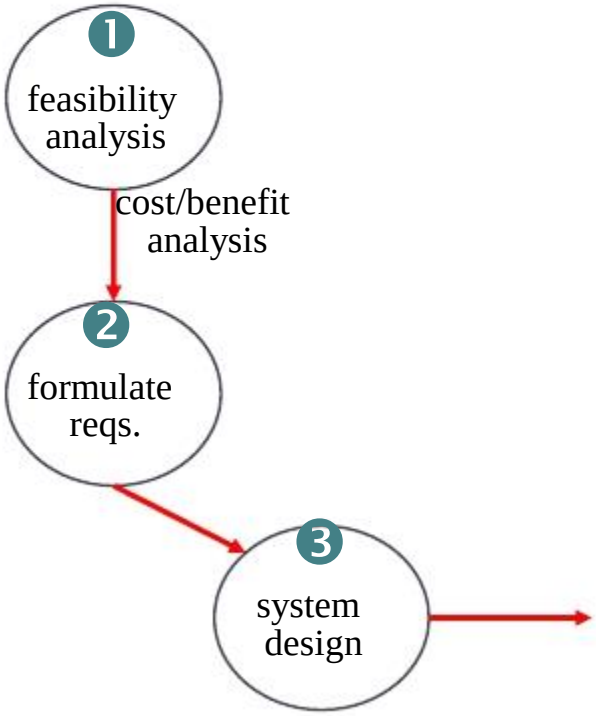
1. Feasibility analysis
2. Requirements formulation
3. System design
4. Database design
5. Implementation
6. Validation and acceptance testing
7. Loading/data conversion
8. Operation
    - . Conversion Training
    - . Monitoring and tuning
    - . New requirements



Development Methodology using a DBMS

Feasibility Analysis

- *Feasibility analysis* determines if it even makes sense to implement the information system.
  - Cost/benefit analysis
  - Capability to implement system



Steps ❷ and ❸

- *Requirements formulation* determines what the information system will do.
  - Determine needs via interviews with potential users
  - Sort out interaction with other systems, computerized, procedural or legal
- *System design* maps the requirements into a coherent structure of high-level modules.
  - The database will be only one part of the information system.

Example: Film Club

- Booking database is only a piece of the Film Club information system.
- Other databases
  - Personnel database: salaries, hire dates, positions, managers
  - Purchasing database: Equipment price , outstanding orders
  - Store ledger: operating expenses, cash on hand, insurance, other assets and liabilities, tax information

Example: Film Club

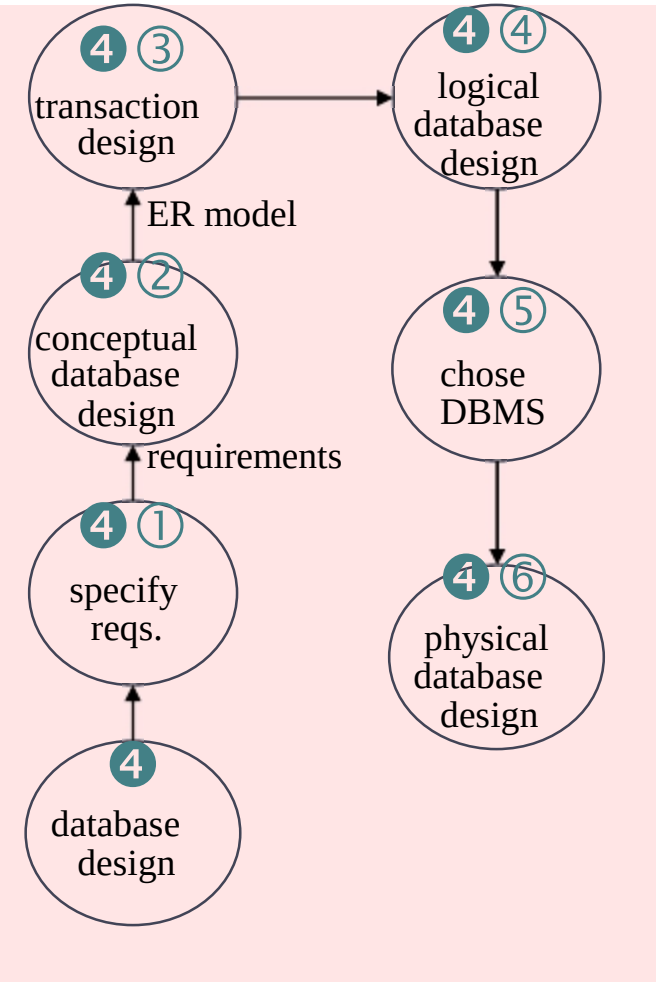
- Often these database have to interact.
  - Pricing of booking may depend on purchase price of the Film.
  - Reservation and booking demand should feed back into purchasing.
  - Salary information needs to feed into the store ledger.
- Determining potential interactions is a major part of information system feasibility analysis and design.

❹ Database Design

- *"Design the logical and physical structure of one or more databases to accommodate the information needs of the users in an organization for a defined set of applications."*
- Satisfy content requirements.
- Provide a well-structured database.
- Satisfy processing requirements.
  - Response time
  - Processing time
  - Storage space

The Phases of Database Design

① Requirements specification
② Conceptual database design
③ Transaction design
④ Choice of DBMS
⑤ Logical database design
⑥ Physical database design



database design phase

① Requirements Specification

- *"Establish all data requirements and processing requirements of the users.“*
- Identify users and applications
- Study legacy systems
- Describe requirements
- Many specification techniques exist

Film Club Database Requrements

- Users are club clerks.
- There may be existing member booking systems.
- Requirements
  - Member can reserve films.
  - Member can book show.
  - New film can be added to the system.
  - Films can be classified. The actors (in films) and the
  - music groups (in music films) can be identified.
  - Members can be designated as preferred customers.
  - Employees can be promoted to management positions.

② Conceptual Database Design

- *"Develop a conceptual description of the database, the conceptual schema."*
- Capture the structure, meaning, interrelationships, and constraints of the data
- The design will serve as indispensable documentation.
- Use a DBMS-independent data model
  - Expressiveness
  - Simplicity
  - Minimality
  - Diagrammatic representation
  - Formal basis
- ER Model

③ Transaction Design

- *"Specify the functional requirements and properties of known transactions."*
- Input and output
- Functional behaviour
- Frequency
- Importance
- Processing and response time requirements
- Retrieval/update/mixed transaction

Film Club: Booking Transaction

- Input memberID and filmID
- Functional behaviour
  - Verify that member account is active, and that the member at what level.
  - Remove reservation, if present.
  - Charge member the extra cost if apply.
  - Mark one seat is occupied.
- Frequency: up to 10 transactions a minute in a busy club.
- Importance: customers are waiting, and so this transaction is highly important.
- Requirements: transaction must take no more than 3 seconds to complete.

④ Logical DB Design (Data Model Mapping)

- *"Create logical (and external) schemas using the data model of the available DBMS."*
- Direct mapping of conceptual schema
  - Discussed in detail for the EER-to-relational case.
- Tailor the logical schema
  - In the relational model, normalization concepts may be applied.*"Evaluate prospective DBMSs against relevant factors."*

Choice of DBMS

- "Evaluate prospective DBMSs against relevant factors.“
- Technical factors
  - Data model, storage structures, interfaces, query languages, tools, availability of service, etc.
- Political factors
  - E.g., high-level strategic decisions
- Economic factors
  - Up-front software and hardware purchase costs
  - Maintenance (service) cost
  - Personnel cost
  - Training cost and Operating cost
- It may be best to simply use a file system.

Film Club

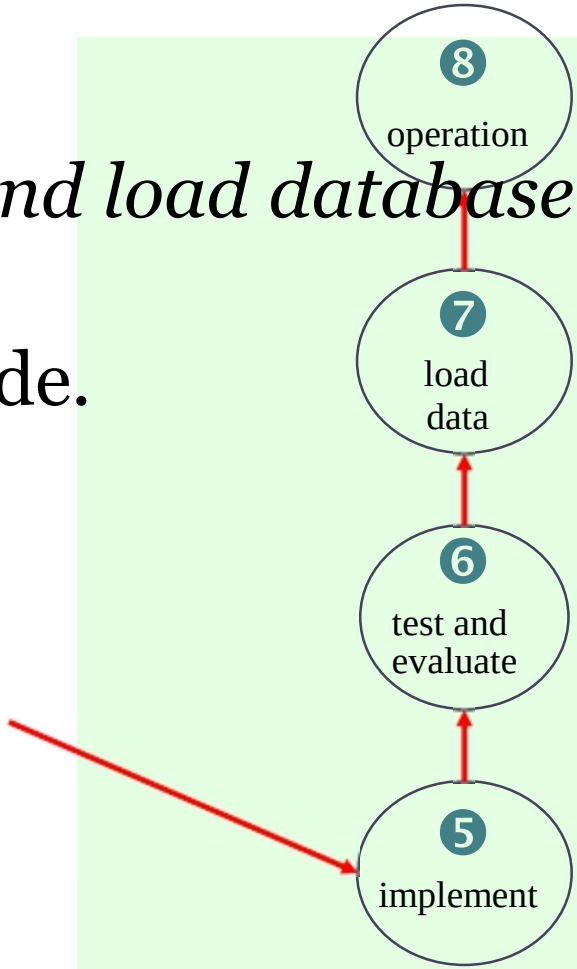
- Booking a show needs to be integrated with point of sale (POS) terminals.
- Order processing DBMS needs to be compatible with corporate DBMS, which may need to be compatible with major distributor DBMS's.
- High reliability is very important. Transaction processing speed is probably less important.
- DBMS must be able to be operated by non-technical personnel.

⑥ Physical Database Design

- *"Select storage structures and access paths that satisfy the processing requirements.“*
- Make initial selection.
- Test to see if the requirements are met.
  - Analytical tests, prototyping, simulation
- Parameters
  - Record size, and quantity; file growth
- Tuning

❺ Database System Implementation

- *"Write and compile code and load database."*
- Develop application code.
- Compile DDL and DML code.
- ❻ Test and evaluate
- ❼ Load and convert data
- ❽ Operation



implementation phase

Summary

- Successful design depends on an iterative approach, starting at an abstract level and adding detail.
- Appropriate data models at each level focus on the important aspects.
- The end result is a fully elaborated design, with each major design decision well documented.
- Modification should proceed from the appropriate level downward.