پوهنتون کابل

پوهنحی کمپیوترساینس

Introduction to Database and Data Models

Lectures 17-18

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Introduction to Database and Data Models - Entity Relationship ER

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2010

Existence Dependency

- Specifies whether the existence of an entity depends on its participation in a relationship or not

Existence Dependency

- There are two types of existence dependencies
  - **Total participation** -an entity can exist only if it participates in a specific relationship
    - Weak entities always have total participation
  - **Partial participation** -an entity can exist without participating in a specific relationship

Relationship Strength

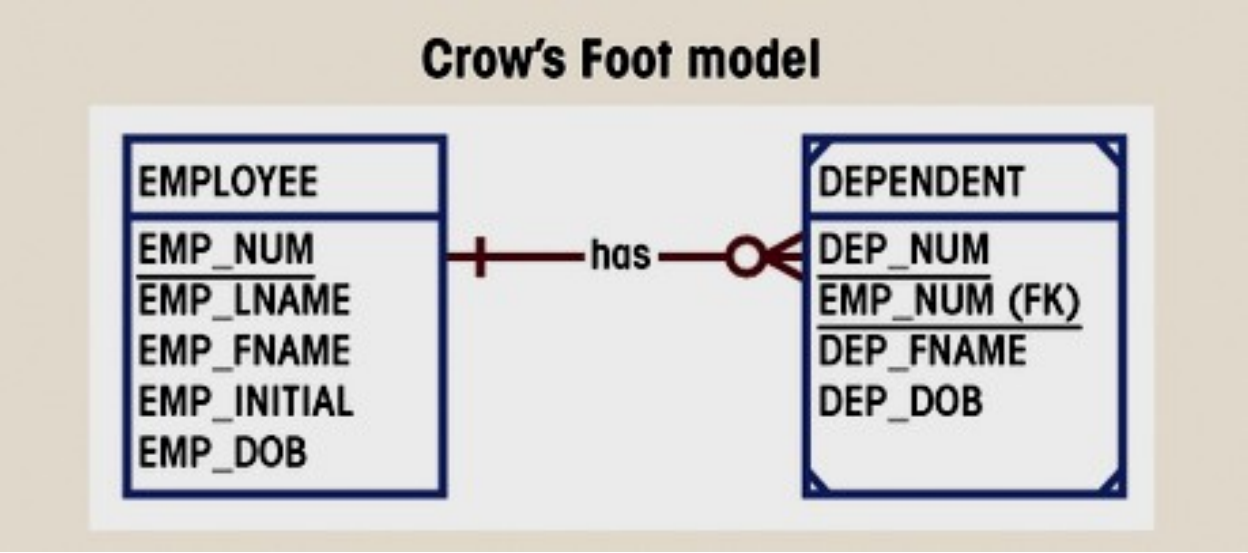
- Opposite to the entity strength
- Existence dependent
  - Existence-dependent entities can not exist apart from parent entities
  - Existence-independent entities can exist apart from parent entities
  - EMPLOYEE claims DEPENDENT

Relationship Strength

- Weak (non-identifying)
  - One entity is existence-independent on another
  - PK of related entity does not contain PK of parent entity
- Strong (identifying)
  - One entity is existence-dependent on another
  - PK of related entity contains PK of parent entity

Weak Entity

- Existence-dependent on another entity
- Its primary key is partially or totally derived from parent entity (ID-Dependent)

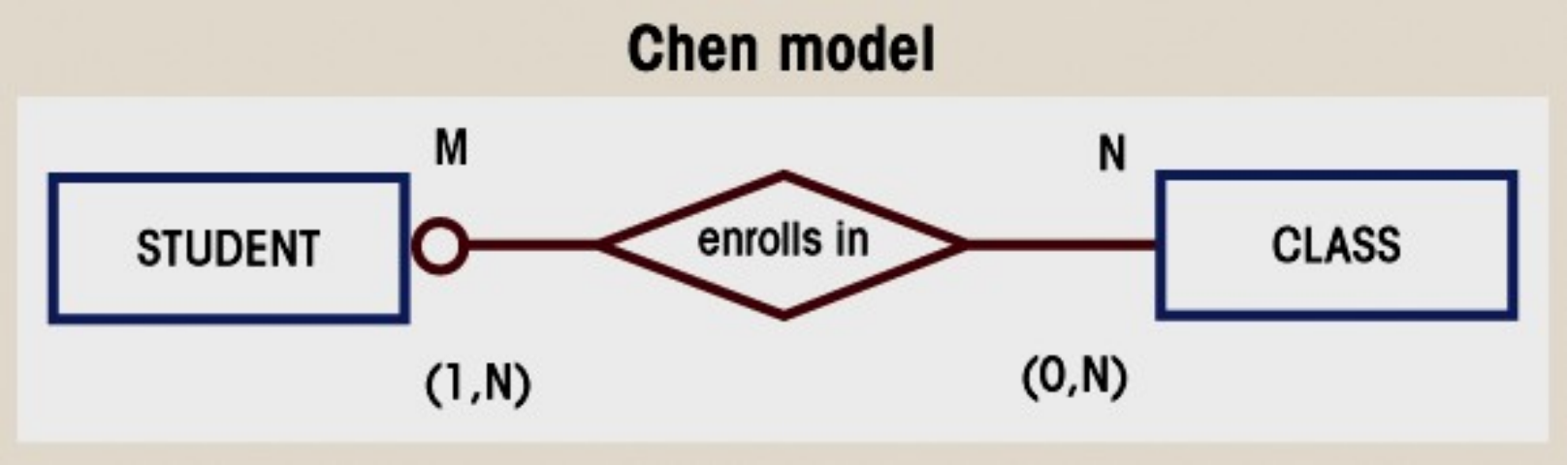


Composite Relationships

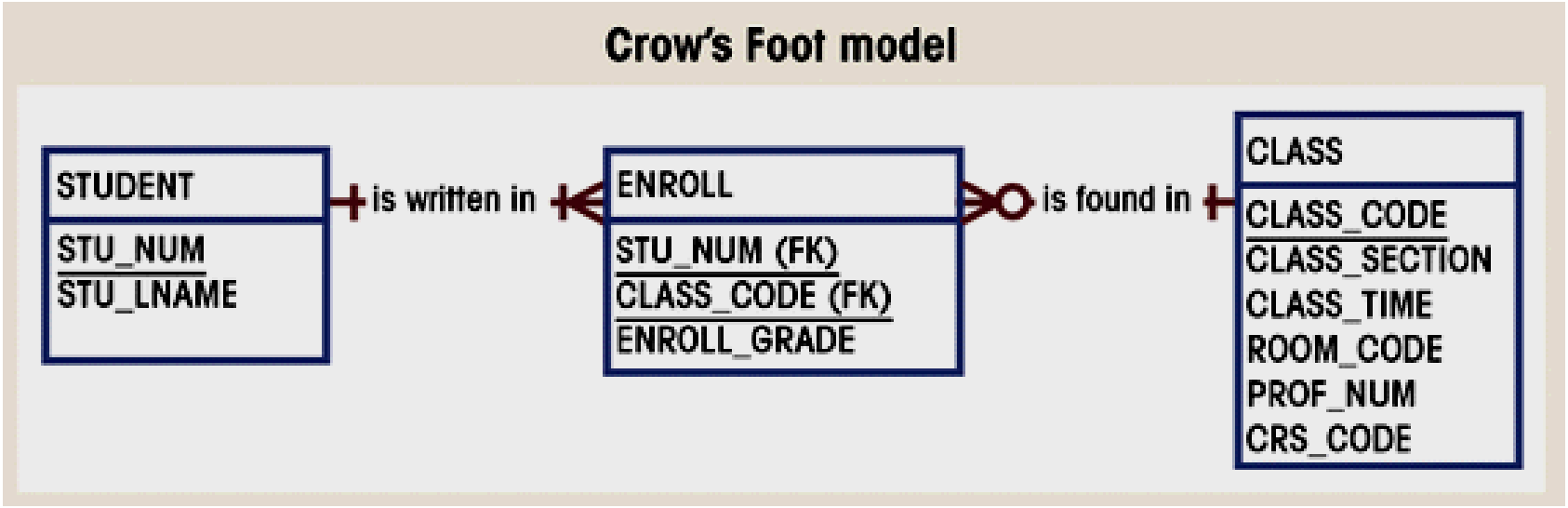
- Association between entities
- Connected entities are called participants
- Operate in both directions

Composite Relationship

- Used to ‘bridge’ between M:N relationships
- Bridge entities composed of primary keys of each entity needing connection



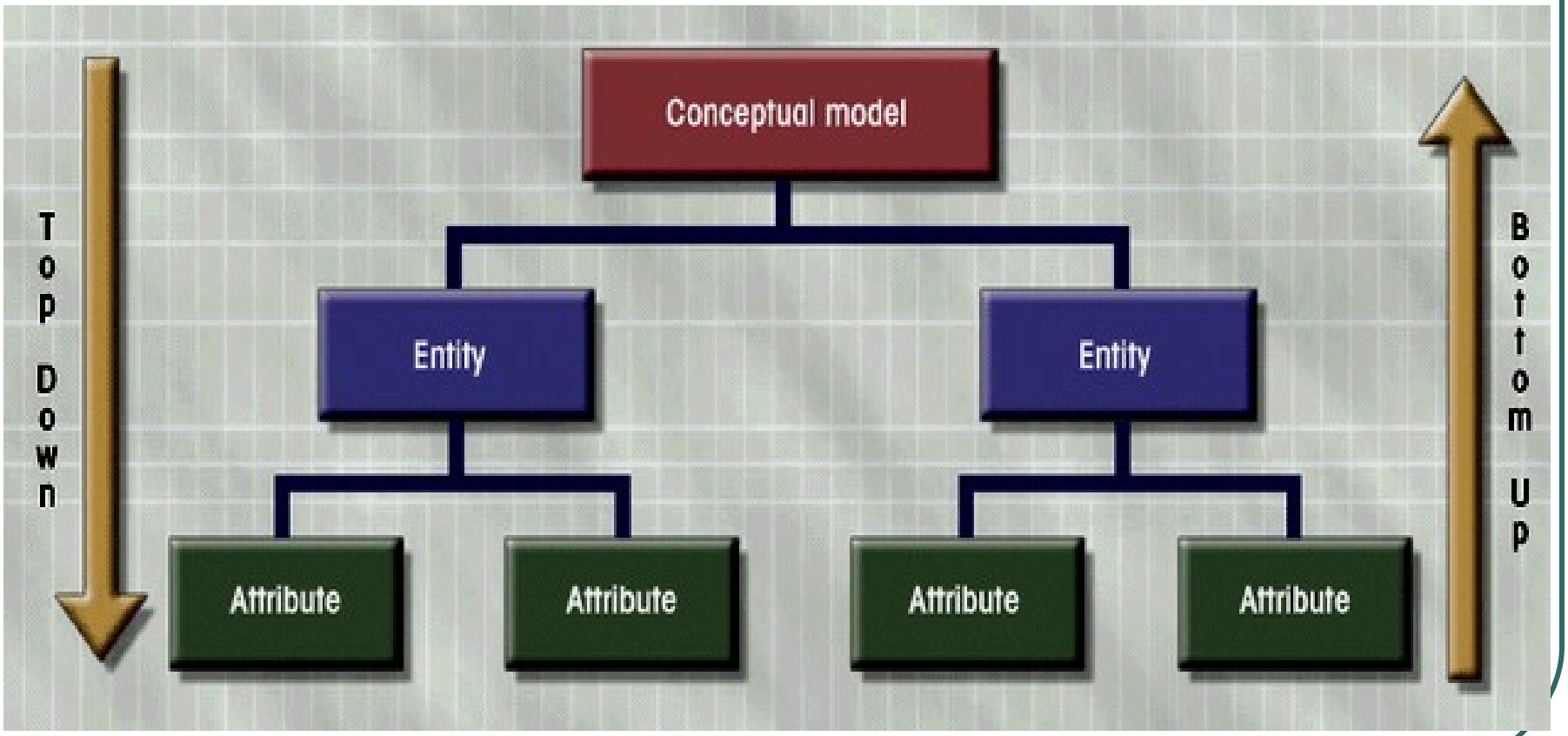
Composite Relationship



DB Design Strategy Notes

- Top-down
  - 1) Identify data sets
  - 2) Define data elements
- Bottom-up
  - 1) Identify data elements
  - 2) Group them into data sets

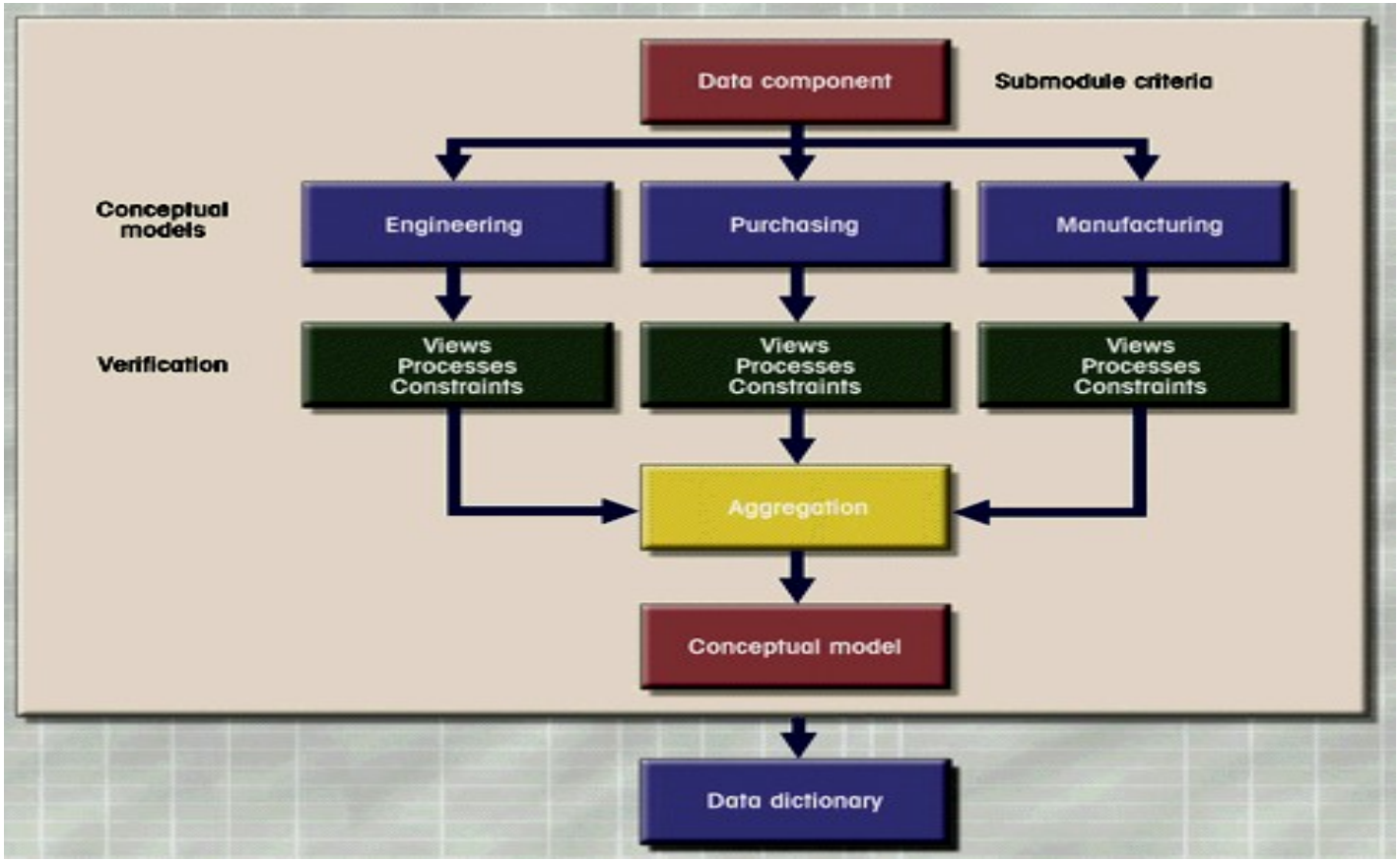
Top-Down vs. Bottom-Up



Centralized vs. Decentralized Design

- Centralized design
  - Typical for simple databases
  - Conducted by single person or small team
- Decentralized design
  - Larger numbers of entities and complex relations
  - Spread across multiple sites
  - Developed by teams

Decentralized Design



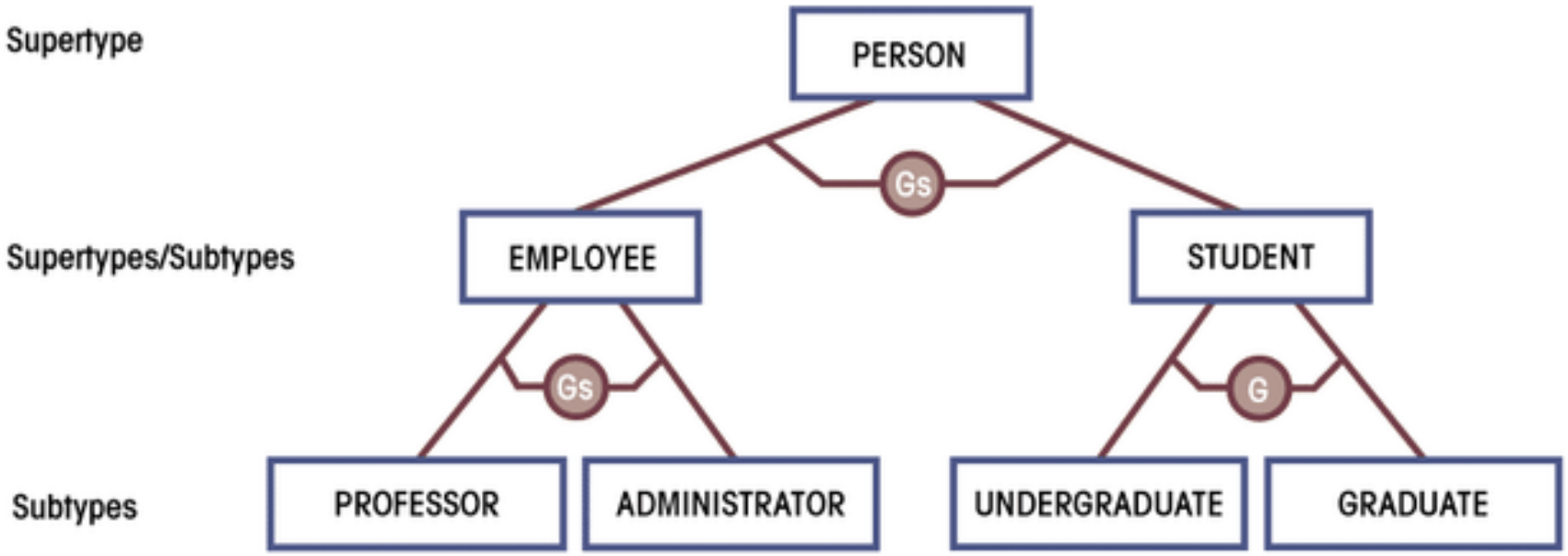
Entity Supertypes and Subtypes

- Generalization hierarchy
  - Depicts relationships between higher-level (supertype) and lower-level (subtype) entities
  - Supertype has shared attributes
  - Subtypes have specific attributes

Entity Supertypes and Subtypes

- Generalization hierarchy
  - Disjoint relationships
    - Unique subtypes
    - Non-overlapping
    - Indicated with a '**G**' or 
  - Overlapping subtypes use '**Gs**' Symbol or 

Entity Supertypes and Subtypes



Comparison of E-R Modeling Symbols

- Alternate styles developed to enable easier use of CASE tools
- Chen
  - Moved conceptual design into practical database design arena
- Crow's feet
  - Cannot detail all cardinalities

Comparison of E-R Modeling Symbols

- Rein85
  - Similar to Crow's feet
  - Operates at higher level of abstraction
- IDEF1X
  - Derivative of ICAM studies in the late 1970's
  - Uses fewer symbols

Comparison of E-R Modeling Symbols

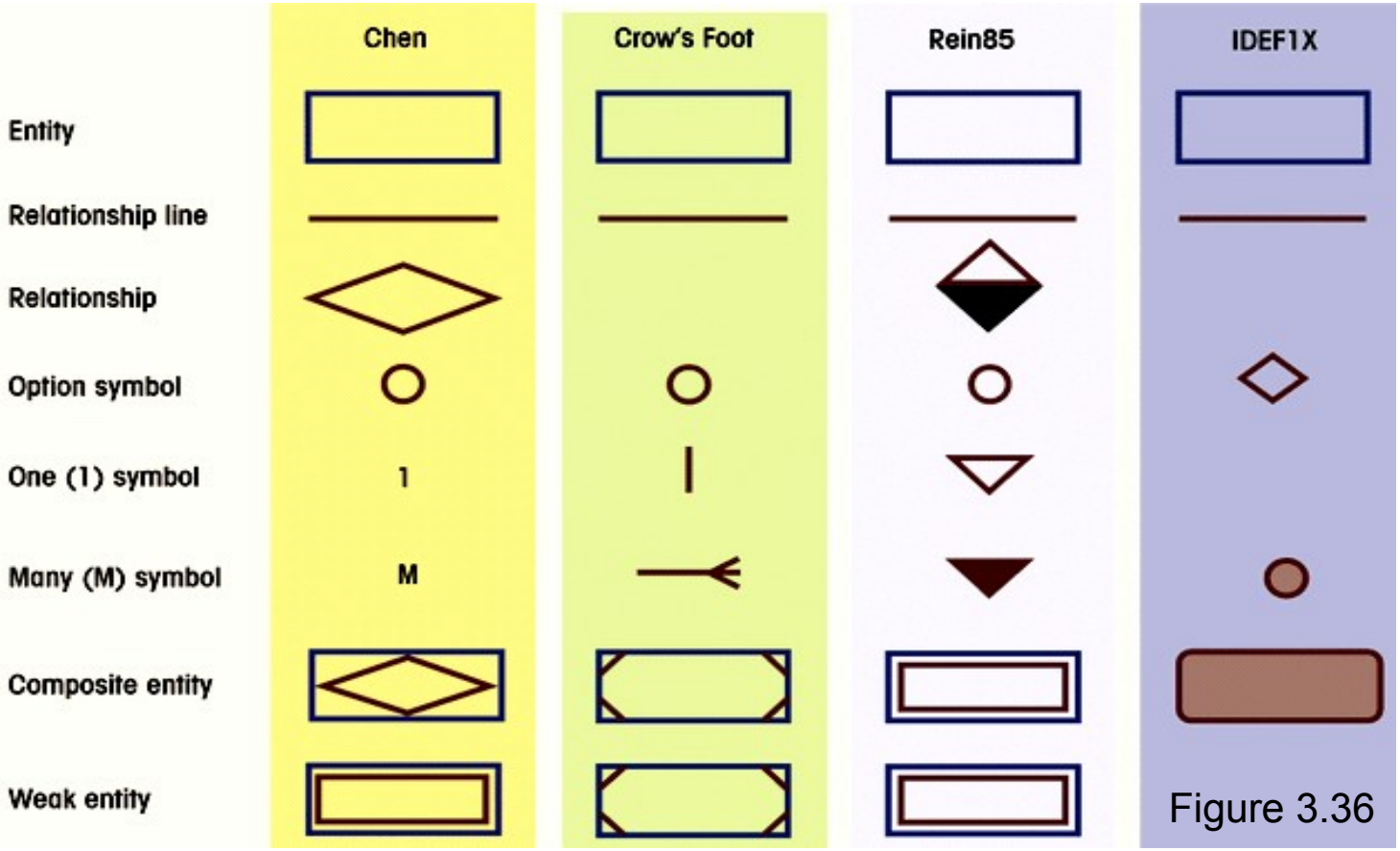
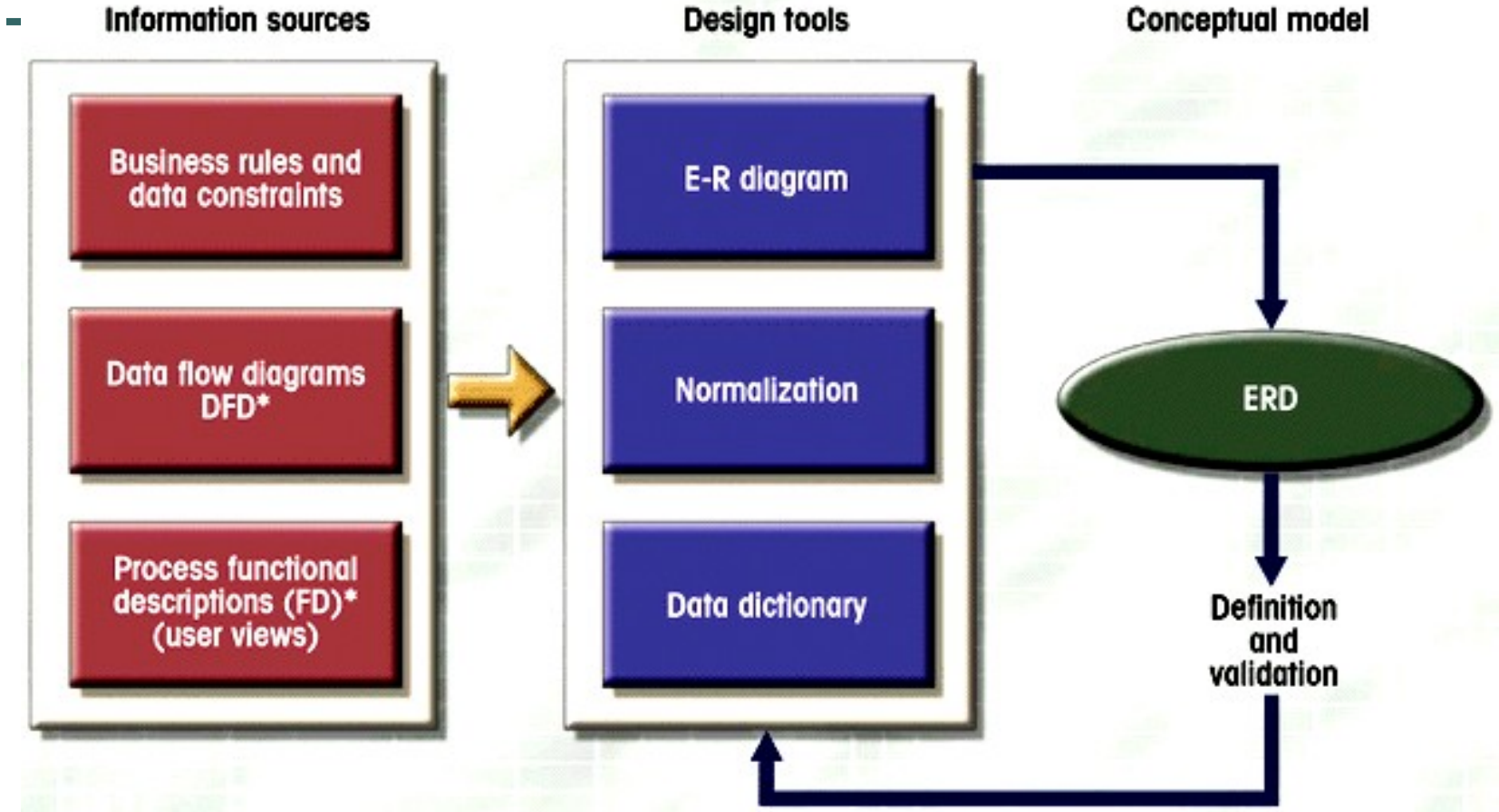


Figure 3.36

Concept Design: Tools and Sources



Conceptual Level Design

- Four steps
  - Data analysis and requirements
  - Entity relationship modeling and normalization
  - **Data model verification**
  - Distributed database design

E-R Model Verification

- E-R model is verified against proposed system processes
  - End user views and required transactions
  - Access paths, security, concurrency control
  - Business-imposed data requirements and constraints

E-R Model Verification

- Reveals additional entity and attribute details
- Define major components as modules
  - Cohesiveness
  - Coupling

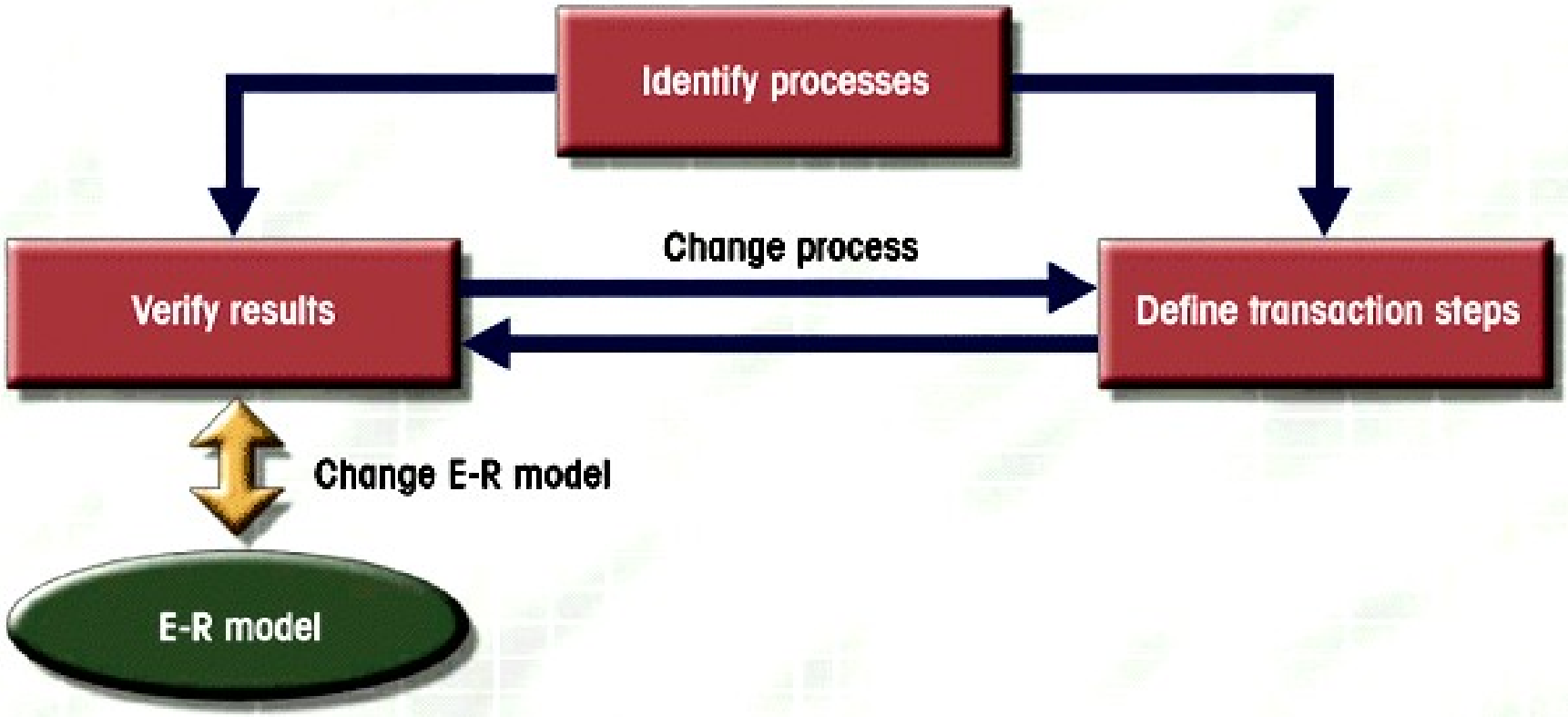
E-R Verification Process

1. Identify the central entity
   - The central entity or repeated entity in E-R Model should be identified
2. Identify each module and its components
3. Identify each module's transaction requirements:
   - Internal: Updates, Deletes, Queries, Reports
   - External: Module Interfaces

E-R Verification Process

1. Verify all processes against the E-R model
2. Make any necessary changes suggested in step 4
3. Repeat steps 2 through 5 for all modules

Iterative Process of Verification



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Conceptual Level Design

- Four steps
  - Data analysis and requirements
  - Entity relationship modeling and normalization
  - Data model verification
  - **Distributed database design**

Distributed Database Design

- Design portions in different physical locations
- Development of data distribution and allocation strategies

Logical Design

- Translates conceptual design into internal model
- Maps objects in model to specific DBMS constructs
- Design components
  - Tables
  - Views
  - Access authorities
  - Indexes
  - Transactions
  - etc

DBMS Software Selection

- DBMS software selection is critical
- Advantages and disadvantages need study
- Factors affecting purchase decisions are:
  - Cost
  - DBMS features and tools
  - Underlying model
  - Portability
  - DBMS hardware requirements

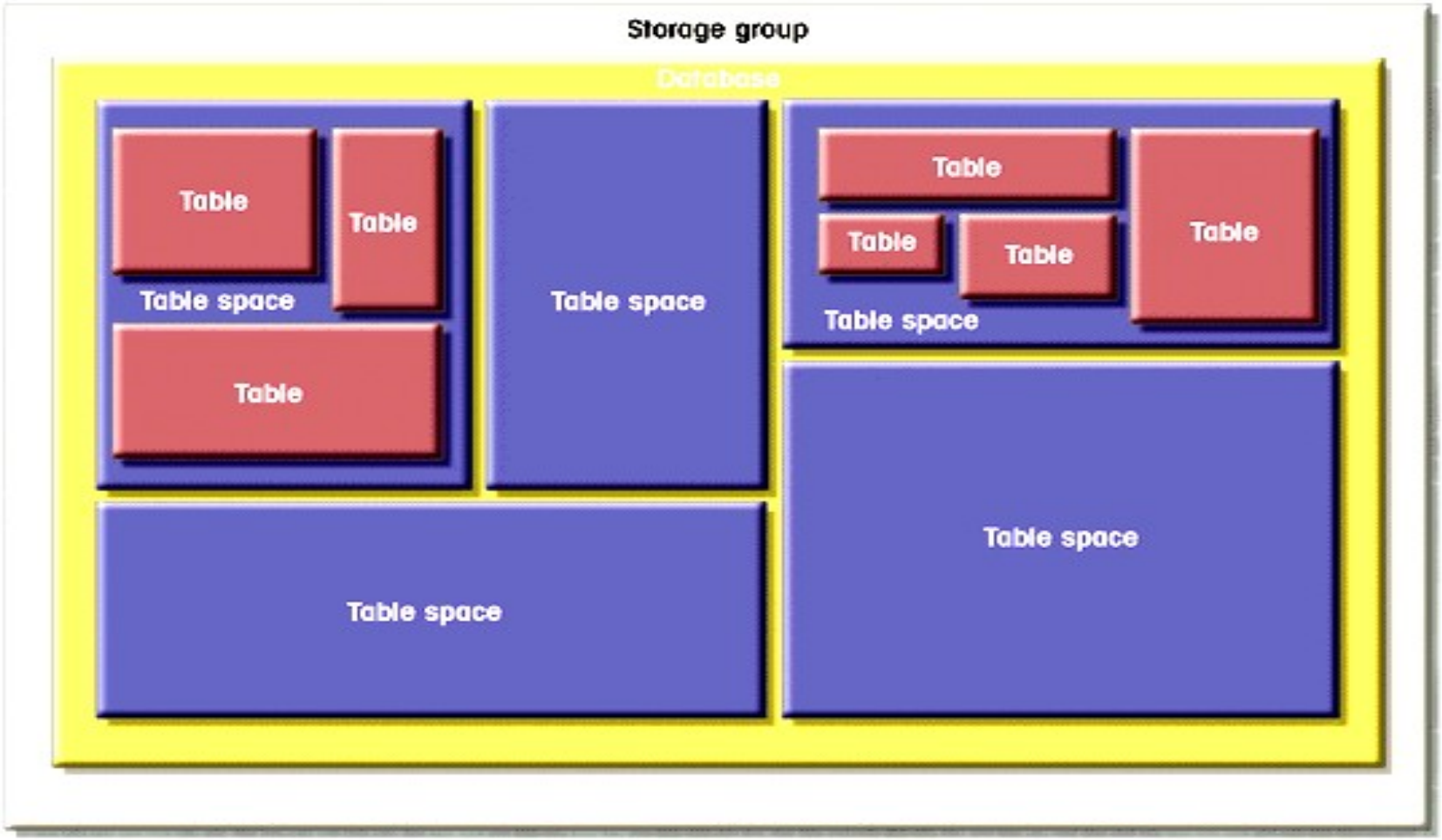
Physical Design

- Selection of data storage and access characteristics
  - Very technical
  - More important in older hierarchical and network models

Physical Design

- Becomes more complex for distributed systems
- Designers favor software that hides physical details

Physical Organization



Implementation & Loading

- Creation of special storage-related constructs to house end-user tables
- Data loaded into tables
- Other issues
  - Performance - Security
  - Backup and recovery - Integrity
  - Company standards - Concurrency controls

Testing & Evaluation

- Database is tested and fine-tuned for performance, integrity, concurrent access, and security constraints
- Done in parallel with application programming
- Actions taken if tests fail
  - Fine-tuning based on reference manuals
  - Modification of physical design
  - Modification of logical design
  - Upgrade or change DBMS software or hardware

Operation

- Database considered operations
- Starts process of system evaluation
- Unforeseen problems may surface
- Demand for change is constant

Documentation

- Design processes should be fully documented
  - UoD
  - Business Rules
  - ER Model or Relational Model
  - Physical structures and relationships
  - Interface components and formats
  - Data access and backup methods

Maintenance & Evaluation

- Preventative maintenance (PM)
- Corrective maintenance
- Adaptive maintenance
- Assignment of access permissions
- Generation of database access statistics to monitor performance
- Periodic security audits based on system-generated statistics
- Periodic system usage-summaries

Challenge of Database Design: Conflicting Goals

- Database must be designed to conform to design standards
- High-speed processing may require design compromises
- Quest for timely information may be the focus of database design

Challenge of Database Design: Conflicting Goals

- Other concerns
  - Security
  - Performance
  - Shared access
  - Integrity

The Final Slide

Good Luck!