Database Concepts and Definitions

- Database: Collection of related data, representing objects and events.
- Data: Meaningful representations of entities.
- Information: Processed data that enhances knowledge.
- Metadata: Data describing other data (e.g., properties, context).

Advantages of Database Approach

- Reduces data redundancy, improving consistency.
- Enhances accessibility, security, and integrity.
- Increases data independence and productivity.

Disadvantages of Database Approach

- Higher development and maintenance costs.
- Potential performance issues and design complexity.
- Security vulnerabilities.

Database Environment

- Key Entities: DBMS, DBA, applications, data, metadata, hardware/software.
- Applications: Personal, two-tier, multitier, enterprise.

Database Development Process

- Iterative process involving analysis, design, implementation, and administration.

Key Entities

- DBMS: Software that manages and controls the database.
- DBA: Person responsible for database design and administration.
- Data Warehouse: Repository for historical data.
- ERP System: Enterprise-wide software for managing business processes.
- Database: Organizes and stores related data about objects and events.
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Data Models

- Conceptual representations of data using entities, attributes, and relationships.

Relational Databases

- Use common fields in tables to connect entities.

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File Processing Systems (Negative Aspects)

- Program-data dependency
- Data duplication
- Limited sharing
- Long development times
- Describes the characteristics and context of data.

File Processing Systems

- Program-data dependency
- Data duplication
- Limited sharing
- Long development times
- Excessive maintenance

The Database Approach

Data Models

- Entities (e.g., customers)
- Attributes (e.g., customer name)
- Relationships (e.g., customers place orders)

Relational Databases

- Customer-Order relationship linked by customer number

Database Management Systems (DBMS)

- Data independence, integrity, and concurrency control

Advantages of the Database Approach

- Program-data separation
- Controlled data redundancy
- Enhanced data consistency
- Shared data resources

- Reduced development time and effort
- Enforcement of standards
- Improved data quality
- Enhanced data accessibility
- Reduced maintenance burden

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Database Applications:

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Evolution of Database Systems:

- Early hierarchical and network data models.
- Relational data model.
- Object-oriented data model.

Data Warehouses:

Database Environment Components

- CASE Tools: Assist in database and application design
- Repository: Centralizes data definitions and system components
- DBMS: Manages and accesses databases
- Database: Collection of related data
- Application Programs: Manage database and provide information
- User Interface: Facilitates user interaction
- Data and Database Administrators: Manage data
- System Developers: Design new applications
- End Users: Interact with the database

Database Applications

- Personal Databases: Single-user, limited sharing
- Two-Tier Client/Server Databases: Small workgroups, data shared on LAN
- Multitier Client/Server Databases: Larger groups, separate components
- Enterprise Resource Planning (ERP) systems
- Data warehouses

Evolution of Database Systems

- Early Systems: Hierarchical and network data models
- Relational Systems: Relational data model

Database Development Process

The Three-Schema Architecture provides different perspectives for users, designers, and implementers. It includes external schemas (user views), conceptual schemas (enterprise data model), and internal schemas (logical and physical schemas).

Database development involves a project team led by a project leader and includes roles like business analysts and data modelers.

Key data modeling concepts include entities, relationships, and attributes. The data model represents data in tables with primary keys and indexes. Analysis and requirements gathering identify data for decision-making.

Key Concepts:

- Entities: Real-world objects (e.g., customers, products)
- Relationships: Connections between entities (e.g., orders placed by customers)
- Attributes: Characteristics of entities (e.g., customer names, product descriptions)

Project Data Model

- Example: Pine Valley Furniture Company
- Four tables: Customer, Product, Order, OrderLine

- Relationships established through common attributes (e.g., CustomerID)

Data Analysis and Requirements

- Goal: Identify data for decision-making
- Methods: Interviews, data exploration, analysis
- Data attributes include demographics, sales, time-related data

Database Design

- Tables created in SQL
- Primary keys for unique row identification
- Indexes for query optimization

Data Model

- Shows table relationships and attributes
- Foreign keys link tables for cross-entity analysis

Database Usage

- Ad hoc queries and standard reports
- Queries retrieve data based on specific criteria
- Reports present data in structured formats

Database Administration

- Databases organize logically related data, described by metadata.
- A DBMS manages database creation, maintenance, and access.
- The database approach integrates data, overcoming file system limitations.

Database Development

- Enterprise data modeling defines database scope.
- Development methodologies include SDLC and prototyping.
- Schemas provide different database perspectives for various users.

Client/Server Architecture

- This model separates data presentation (client) from data management (server).

Relationships

- Databases emphasize data integration and sharing.
- Database development involves data modeling, project teams, and methodologies.
- Schemas cater to specific user needs.
- Client/server architecture provides flexibility.
- Agile development focuses on iteration and user involvement.

Home Office Product Line Marketing Support System

- This case study demonstrates a personal DBMS and SQL usage.
- <p>Databases organize structured data and are managed by DBMSs for creation, maintenance, an

- Databases overcome file system limitations by integrating data.

Database Development and Relationships

- Database development involves enterprise data modeling and methodologies like SDLC and prototy
- Schemas provide different perspectives on the database for various users.
- Databases emphasize data sharing and integration.

Client/Server Architecture

- This model separates data presentation (client) from management (server) for flexibility.

Data Modeling

- Data modeling represents organizational data using entities, attributes, relationships, and rules.
- Conceptual models define logical data structure, while logical models translate them into specific mo
- Represent organizational data
- Entities, attributes, relationships, and business rules define data structure and semantics
- Used for planning, communication, and data management

Conceptual Data Models

- Logical data structure independent of technology
- Cardinality specifies relationships between entities

Logical Data Models

- Data structure using a specific model (e.g., relational)
- Tables, columns, primary keys, and foreign keys represent entities, attributes, and relationships
- Translate conceptual data models into specific models

Physical Data Models

- Physical storage and implementation of data
- Files, records, fields, and indexes represent data physically
- Database: Collection of related data organized by topic.
- Data: Meaningful representations of real-world entities.
- Information: Processed data that enhances knowledge.
- Metadata: Data that describes other data, such as its properties and context.

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- Multitier Client/Server Databases: Larger groups, separate components.
- Enterprise Applications: Support organization-wide operations (e.g., ERP systems

Evolution of Database Systems

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Data Warehouses

- <p>Databases enhance quality by providing accurate patient information for diagnosis and treatmen
- They reduce costs by optimizing resources and automating processes.
- Personalized care is enabled by tailoring treatments to individual needs.

2. HIPAA Compliance

- Databases help hospitals maintain secure access to electronic health information and comply with H
- Encryption, authentication, and access controls protect data confidentiality and integrity.

3. Costs and Risks

- Database costs include hardware, software, and data management.
- Risks include data loss, security breaches, and performance issues.

4. Data Quality

- Data quality is essential for accurate decision-making and patient safety.
- Quality requirements are stricter for applications like diagnosis and treatment planning.

5. Data Types and Technology

- Relational databases are suitable for structured data.
- NoSQL and specialized databases may be better suited for unstructured data like images.

6. Web-Based Applications

- Hospitals use web-based applications for patient portals, remote monitoring, and online scheduling.
- Benefits include accessibility, convenience, and patient engagement.
- Security concerns, data privacy, and technical issues are potential risks.

7. Business Rules

- A patient can have multiple charges.
- A charge is associated with a specific patient.
- A physician can admit multiple patients.