INF 3703

Distributed Database Management System (DDBMS)

- Governs storage and processing of logically related data.
- Interconnected computer systems
- Both data and processing functions are distributed among several sites.

Centralized Database requires that corporate data be stored in a single central site.

DDBMS Advantages

- Data are located near "greatest demand" site.
- Faster data access
- Faster data processing
- Growth Facilitation
- Improved communications
- Reduced operating costs
- User-Friendly interface
- Less Danger of single Point Failure

DDBMS Disadvantages

- Complexity of management and control
- Security
- Lack of standards
- Increased storage requirements
- Costs, (training, duplicate Hardware, licensing, etc)

Distributed Processing

- Database's logical processing is shared among 2 or more physical sites.
- Connected through a network

Distributed Database

- Stores logically related database over 2 or more physically independant sites
- Database composed of database fragments.

Characteristics Of Distributed Management Systems.

Application interface, Validation, Transformation, Query optimization Mapping, I/O interface, Formatting, Security, Backup and Recovery, DB Administration, Concurrency Control, Transaction Management.
Must perform all the functions of a centralized ~~database~~, DBMS,
Must handle all necessary functions imposed by distribution of data and processing.

DDBMS Components

- Computer workstations
- Network Hardware & Software
- Communications media
- Transaction processor (Application processor, transaction manager)
- Data processor or data manager
  - Software component residing on each computer that stores and retrieves data located at the site.
  - May be a centralized DBMS

Information System

Is designed to facilitate the transformation of data into information and to manage both data and information. The Database is important to the information system. It also deals with data collection, storage and retrieval.

System's Analysis (Phase 2 of the SDLC)

Is the process that establishes the need for and the extent of an information system, by Establishing Enduser requirements, Evaluating the existing system, Developing a logical systems design.

System's Development (Based on Detailed Systems Design in Phase 3) of the SDLC)

System's development is the process of creating an information system. The designer completes the design of all required system processes during the system's design phase.

Database Systems

Database systems are one form of an Information System and basically deals with data.

SDLC (Software Development Life Cycle)

Traces the history (life cycle) of an information system. Composed of 5 phases. (Planning, analysis, detailed system design, implementation & maintenance)

DBLC (Database Life Cycle)

Trace the history (life cycle) of a database system. (ie Database initial Study, Database design, implementation and loading, testing and evaluation, operation and maintenance and evolution)

Transaction

A transaction is any action that reads from or writes the database. A transaction is a LOGICAL unit of work that must be entirely COMPLETED or entirely aborted. A successful transaction changes the database from one CONSISTENT STATE to another.

Transaction Properties (ACIDS test)

Atomicity requires that all operations of a transaction be completed, if not the transaction is aborted

Consistency indicates the permanence of the database's consistent state. When a transaction is completed the database reaches a consistent state.

Isolation means that data used during the execution of a transaction cannot be used by a second transaction until the first one is completed.

Durability ensures that once transaction changes are done, it cannot be undone or lost, even in the event of system failure.

Serializability ensures that the concurrent execution of several transaction yields consistent results

DATABASE DESIGN (4 stages)

CONCEPTUAL DESIGN (1st stage in database desing)

Data modelling is used to create an abstract database structure that represents real-world objects in the most realistic way possible. The conceptual model must embody a clear understanding of the business and its functional areas.

MINIMAL DATA RULE

All that is needed is there, and all that is there is needed.

FOUR STEPS FOR CONCEPTUAL DESIGN

- Data analysis & requirements
- Entity relationship modelling and Normalization
- Data Model verification
- Distributed Database Design.

LOGICAL DESIGN (3rd stage in database design)

The aim is to map the conceptual model into a logical model which can then be implemented on a relational DBMS.
The right to use the database is also specified during the logical

DBMS Software Selection (2nd stage in database design)

This is critical to the information system smooth operation.
Factors affecting the purchase decision:

Cost
DBMS features & tools
Underlying Model
Portability
DBMS Hardware requirements

Physical Design (4th Stage)

Is the process of selecting the data storage and data access characteristics of the database.

Integrity

Data Integrity is enforced through the proper use of primary and foreign key rules.

Implementation & Loading

A new database implementation requires the creation of special storage-related constructs to house the end user tables. The constructs usually include the the storage group, the table space and the tables.

Database Security

- The loss of data integrity through unauthorized modification.
- The loss of availibility of data.
- The loss of confedentiality of data
- Theft and fraud of data
- Human Error which causes accidental loss of Data
- Electronic Infections, (Viruses, Email Viruses, Worms, Trojan Horses)

Data Security Measures

Physical Security - Allow only authorized personel physical access to specified areas.

User Authentication - Identify the user and verify that ~~he~~ user is allowed to access some restricted data or application (Passwords & Access Rights)

Audit Trails - Provided by the DBMS to check for access violations. last line of defense, after the fact device.

Data Encryption - Can be used to render data useless to unauthorized users who may have violated some of the database security layers

Testing and Evaluation

Once data has been loaded into the database, the DBA tests & fine-tunes the database for performance, integrity, concurrent access and security constraints. The testing and evaluation phase occurs in parallel with application programming.

Operation

Once the database has passed the evaluation stage, it is considered operational. At that point, the database, its management, its users and its application program constitute a complete information system

Maintenance and Evolution

- Preventative maintenance (backup)
- Corrective maintenance (recovery)
- Adaptive maintenance (Enhancing performance, adding entities & attributes)
- Assignment of access permissions and their maintenance for new & old users.

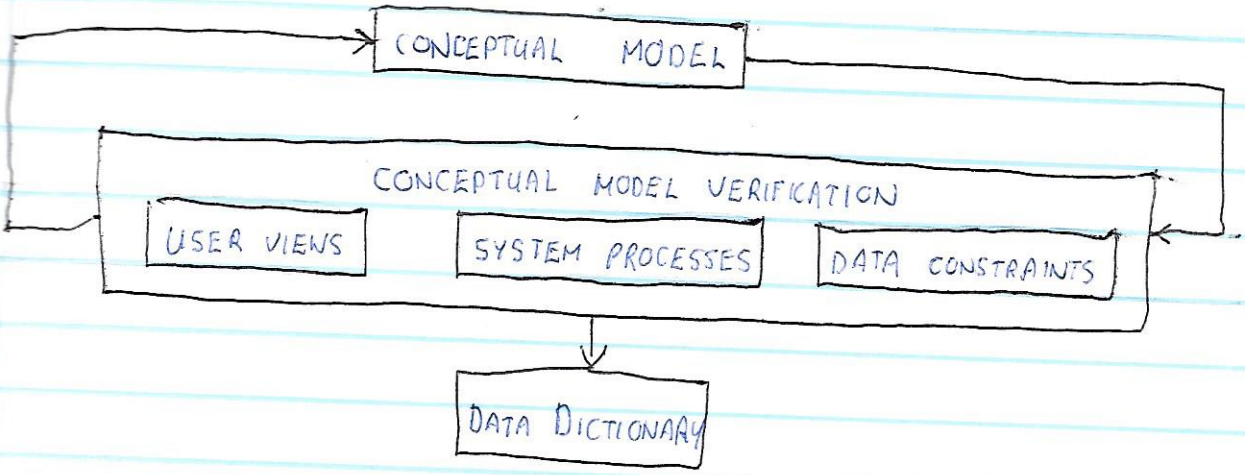
Database Design Strategies / Approaches

- Top-down design starts by identifying the data sets, then defines the data elements for each of those sets. This process involves the identification of different entity types and the definition of each entity's attributes. (Large Databases)
- Bottom-up design first identifies the data elements, then groups them together in data sets. In other words, it first defines attributes, then groups them to form entities. (May be more productive for small DB's)

Centralized Design

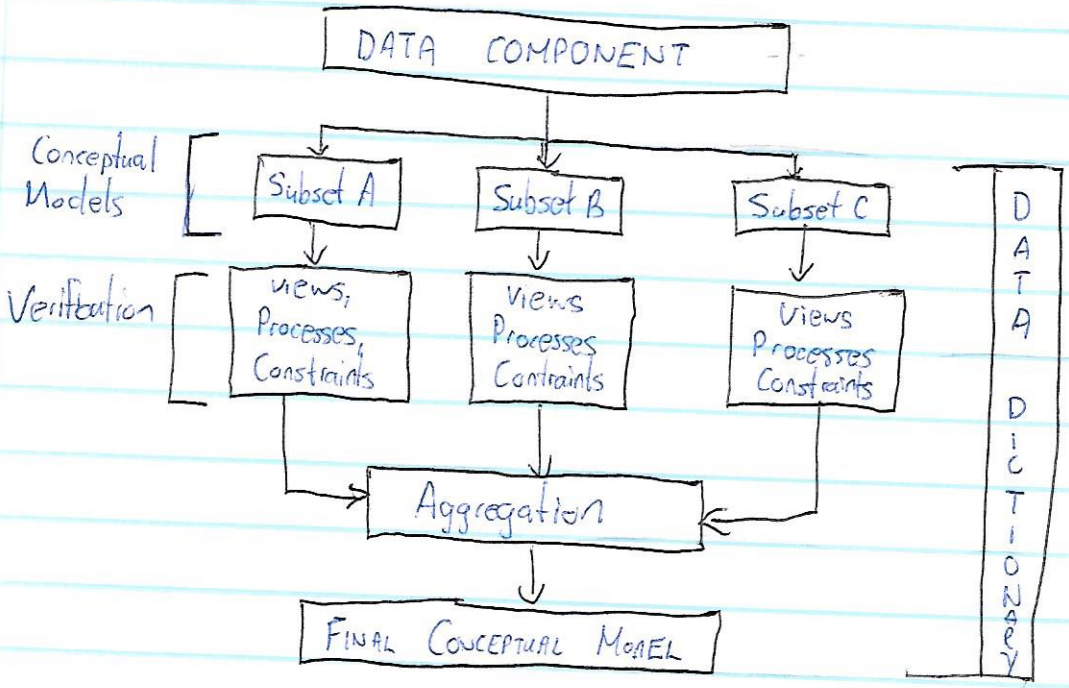
Is productive when the data component is composed of a relatively small number of objects and procedures. The design can be carried out and represented in a fairly simple database. Can be done successfully done by a single person

Centralized Design



Decentralized Design

Requires that the design task be divided into multiple modules, each of which is assigned to a design team. The activities of the design team are coordinated by the lead designer, who must aggregate the design team efforts



Distinction Between Centralized and Decentralized Conceptual Database Design

Are variations of the bottom-up and top-down approches. The CENTRALIZED approach is best suited to small & simple DB's that lends themselves well to a birds eye view of the entire DB.

Managerial Role Of The DBA

-Coordinating, monitoring and allocating database administration resources, people and data.

DBA Activity	DBA Service
Planning	End-user support
Organizing	Policies, Procedures and Standards
Testing	Data security, privacy and integrity
Monitoring	Data backup and recovery
Delivering	Data Distribution and use

End User Support

Gathering User Requirements - DBA must work with End User community to gather data required to identify and decribe End User problems.

Building End User Confidence - Finding adequete solutions to End User's problems increases End-User trust & Confidence in DBA function

Resolving Conflicts - Solving One departments issue may disrupt other departments, DBA's has authority and responsibility to resolve

Finding Solutions To Infomation Needs

Policies, Procedures and Standards

Policies - General statements of direction or action that support DBA goals
eg All users must have passwords, Passwords must be changed every month

Procedures - Authorization form must be completed, Signed by team leader, etc
eg Once DBA has auth form he changes password. (written instructions)

Standards - More detailed & specific than Policies and describe minimum requirements of a given DBA activity. eg Password must have a minimum of 5 chara