18CSE487T - DATA WAREHOUSING AND ITS APPLICATIONS

UNIT-1

Data Warehouse

A subject-oriented, integrated, time-variant, non-updatable collection of data used in support of management decision-making processes

- ***Subject-oriented:*** e.g. customers, patients, students, products
- ***Integrated:*** consistent naming conventions, formats, encoding structures; from multiple data sources
- ***Time-variant:*** can study trends and changes
- ***Non-updatable:*** read-only, periodically refreshed

Data Mart

A data warehouse that is limited in scope

History Leading to Data Warehousing

- Improvement in database technologies, especially relational DBMSs
- Advances in computer hardware, including mass storage and parallel architectures
- Emergence of end-user computing with powerful interfaces and tools
- Advances in middleware, enabling heterogeneous database connectivity
- Recognition of difference between operational and informational systems

Need for Data Warehousing

- Integrated, company-wide view of high-quality information (from disparate databases)
- Separation of *operational* and *informational* systems and data (for improved performance)
- Online Analytical Processing
- Decision Making Systems
- Data mining

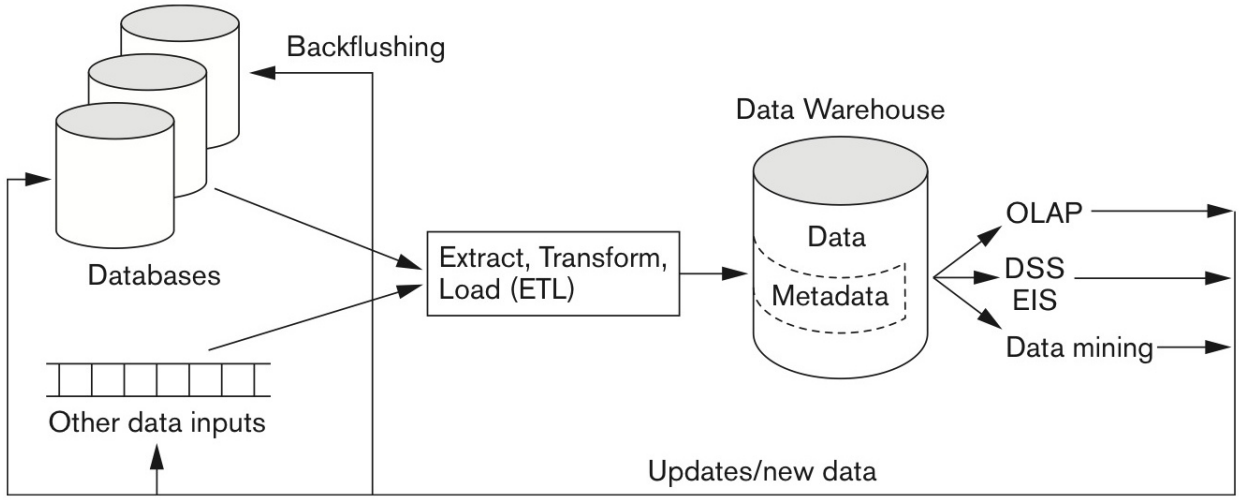
Issues with Company-Wide View

- Inconsistent key structures
- Synonyms
- Free-form vs. structured fields
- Inconsistent data values
- Missing data

Datawarehouse Architecture

- Data Warehouse processing involves
  - Data Sources
  - ETL (Extract, Transform, Load)
  - OLAP – Data Analytics
  - Data Mining

Datawarehouse Architecture (Common)



The major components of a data warehousing process

- **Data sources**: internal, external (data provider), OLAP, ERP, Web data
- **Data extraction and loading**: using custom-written or commercial software called (ETL) and loaded into a staging area to be transformed and cleansed, then loaded into the warehouse
- **Metadata**: to ease indexing and search
- **Middleware tools**: to enable access to DW. It includes data mining tools, OLAP, reporting tools, and data visualization tools.

Extraction, transformation, and load (ETL)

A data warehousing process that consists of:

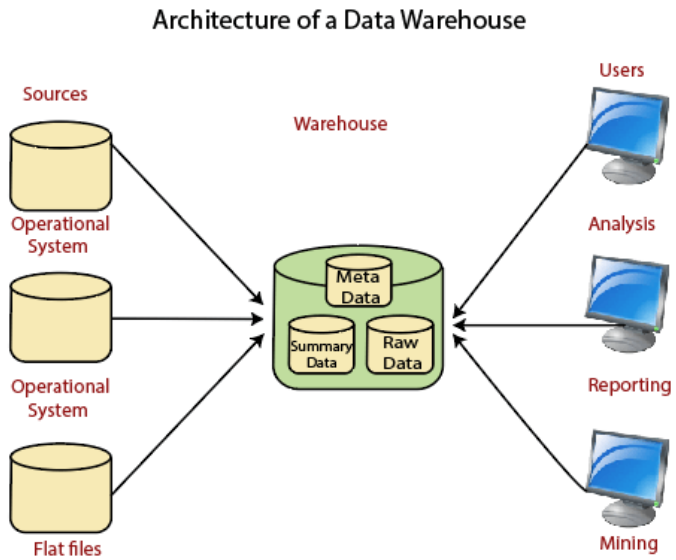
- extraction (i.e., reading data from a database),
- transformation (i.e., converting the extracted data from its previous form into the form in which it needs to be so that it can be placed into a data warehouse or simply another database), and
- load (i.e., putting the data into the data warehouse)

- During extraction process, the input files are written to a set of staging tables, to facilitate the load process.

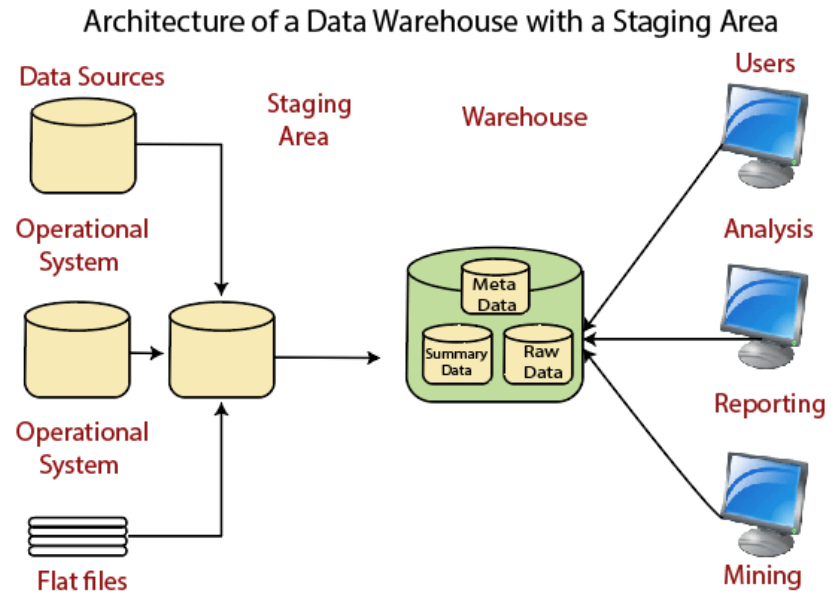
Datawarehouse Architecture types

- Data Warehouse Architecture: Basic
- Data Warehouse Architecture: With Staging Area
- Data Warehouse Architecture: With Staging Area and Data Marts

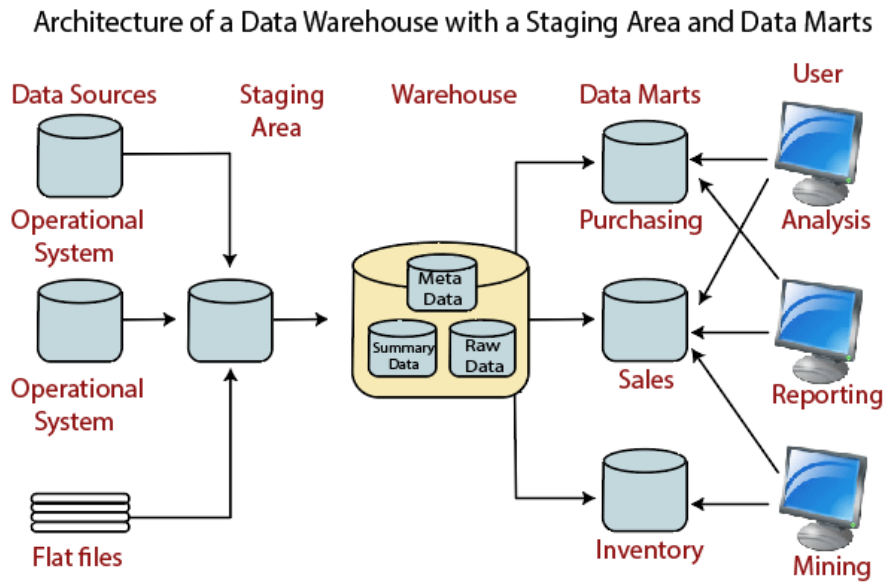
Data Warehouse Architecture: Basic



Data Warehouse Architecture: With Staging Area



Data Warehouse Architecture: With Staging Area and Data Marts



Comparison with Traditional Databases

- Data Warehouses are mainly optimized for appropriate data access.
  - Traditional databases are transactional and are optimized for both transaction processing and integrity assurance.
- Data warehouses emphasize more on historical data as their main purpose is to support time-series and trend analysis.
- In transactional databases transaction is the mechanism of change to the database. By contrast, information in data warehouse is relatively coarse grained and DWs are regarded as non-real time. The periodic refresh policy is carefully chosen, usually incremental.
- Compared with transactional databases, data warehouses are nonvolatile.

Characteristics of Data Warehouses

Based on Codd and Salley (1993) article on providing OLAP to users, the following characteristics of Data Warehouses were identified:

- Multidimensional conceptual view
- Unlimited dimensions and aggregation levels
- Unrestricted cross-dimensional operations
- Dynamic sparse matrix handling
- Client-server architecture
- Multiuser support
- Accessibility
- Transparency
- Intuitive data manipulation
- Inductive and deductive analysis
- Flexible distributed reporting

Datamart

- A **Data Mart** is a subset of a directorial information store, generally oriented to a specific purpose or primary data subject which may be distributed to provide business needs. Data Marts are analytical record stores designed to focus on particular business functions for a specific community within an organization. Data marts are derived from subsets of data in a data warehouse, though in the bottom-up data warehouse design methodology, the data warehouse is created from the union of organizational data marts.

Datamart

- The fundamental use of a data mart is **Business Intelligence (BI)** applications. **BI** is used to gather, store, access, and analyze record. It can be used by smaller businesses to utilize the data they have accumulated since it is less expensive than implementing a dat
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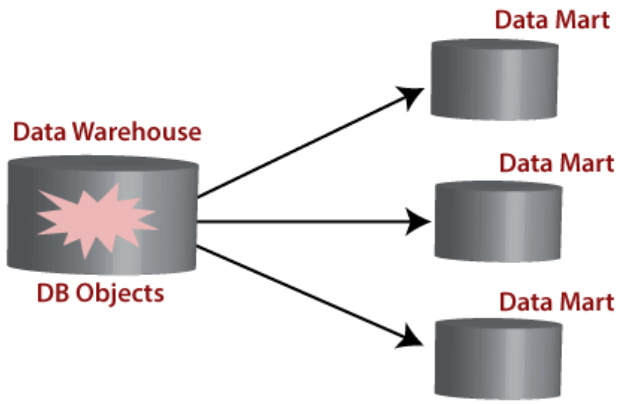


Reasons for creating a data mart

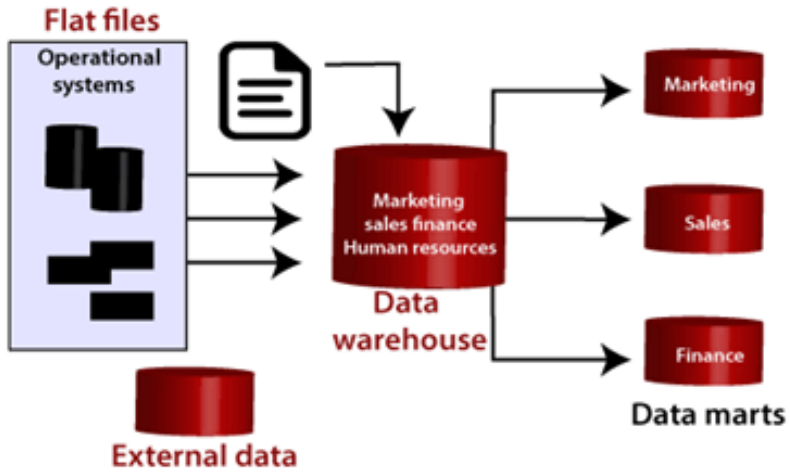
- Creates collective data by a group of users
- Easy access to frequently needed data
- Ease of creation
- Improves end-user response time
- Lower cost than implementing a complete data warehouses
- Potential clients are more clearly defined than in a comprehensive data warehouse
- It contains only essential business data and is less cluttered.

Types of Data Marts

- There are mainly three approaches to designing data marts. These approaches are
- Dependent Data Marts
- Independent Data Marts
- Hybrid Data marts

Dependent Data Marts

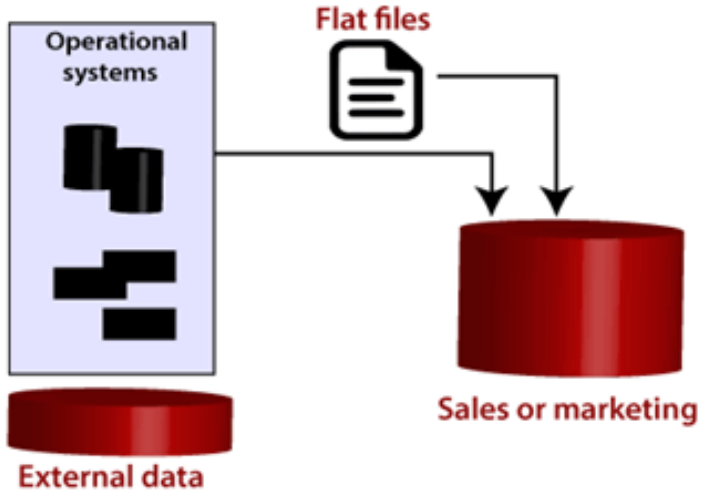
- A dependent data marts is a logical subset of a physical subset of a higher data warehouse. According to this technique, the data marts are treated as the subsets of a data warehouse. In this technique, firstly a data warehouse is created from which further various data marts can be created. These data mart are dependent on the data warehouse and extract the essential record from it. In this technique, as the data warehouse creates the data mart; therefore, there is no need for data mart integration. It is also known as a **top-down approach**.



Dependent Data Mart

Independent Data Marts

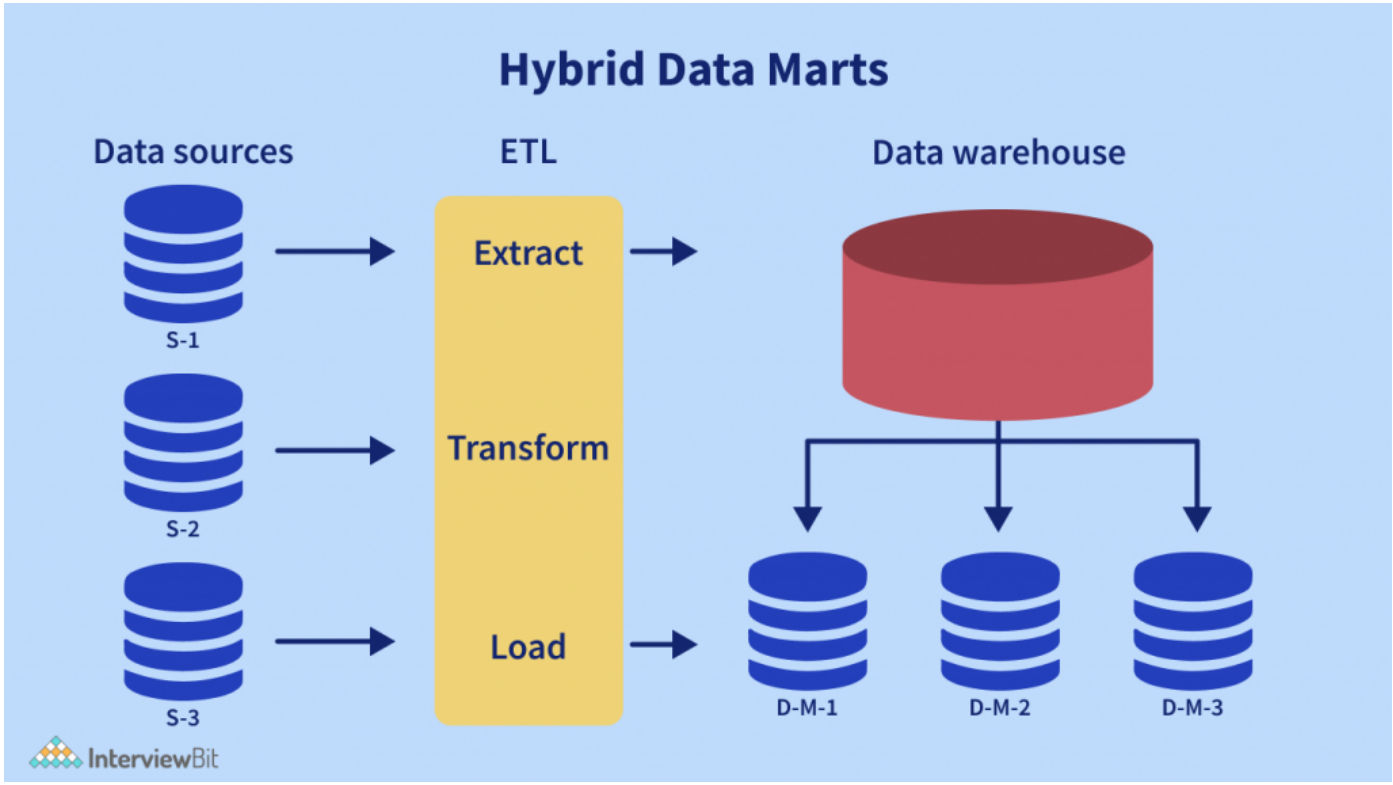
- The second approach is Independent data marts (IDM) Here, firstly independent data marts are created, and then a data warehouse is designed using these independent multiple data marts. In this approach, as all the data marts are designed independently; therefore, the integration of data marts is required. It is also termed as a **bottom-up approach** as the data marts are integrated to develop a data warehouse.



Independent Data Mart

Hybrid Data Marts

- It allows us to combine input from sources other than a data warehouse. This could be helpful for many situations; especially when Adhoc integrations are needed, such as after a new group or product is added to the organizations.
- It forms the datamarts directly from the data source and also from the Datawarehouse.


Hybrid Data Marts
Data sources
ETL
Data warehouse
Extract
Transform
Load
S-1
S-2
S-3
D-M-1
D-M-2
D-M-3
InterviewBit

Steps in Implementing a Data Mart

- Designing
- Constructing
- Populating
- Accessing
- Managing

Designing

- The design step is the first in the data mart process. This phase covers all of the functions from initiating the request for a data mart through gathering data about the requirements and developing the logical and physical design of the data mart.
- It involves the following tasks:
- Gathering the business and technical requirements
- Identifying data sources
- Selecting the appropriate subset of data
- Designing the logical and physical architecture of the data mart.

Constructing

- This step contains creating the physical database and logical structures associated with the data mart to provide fast and efficient access to the data.
- It involves the following tasks:
- Creating the physical database and logical structures such as tablespaces associated with the data mart.
- creating the schema objects such as tables and indexes describe in the design step.
- Determining how best to set up the tables and access structures.

Populating

- This step includes all of the tasks related to the getting data from the source, cleaning it up, modifying it to the right format and level of detail, and moving it into the data mart.
- It involves the following tasks:
- Mapping data sources to target data sources
- Extracting data
- Cleansing and transforming the information.
- Loading data into the data mart
- Creating and storing metadata

Accessing

- This step involves putting the data to use: querying the data, analyzing it, creating reports, charts and graphs and publishing them.
- It involves the following tasks:
- Set up and intermediate layer (Meta Layer) for the front-end tool to use. This layer translates database operations and objects names into business conditions so that the end-clients can interact with the data mart using words which relates to the business functions.
- Set up and manage database architectures like summarized tables which help queries agree through the front-end tools execute rapidly and efficiently.

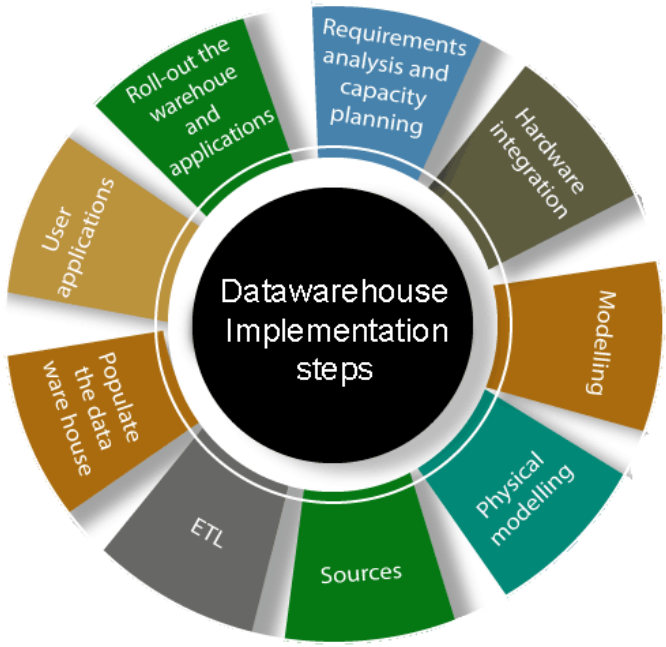
Managing

- This step contains managing the data mart over its lifetime. In this step, management functions are performed as:
- Providing secure access to the data.
- Managing the growth of the data.
- Optimizing the system for better performance.
- Ensuring the availability of data event with system failures.

Datawarehouse vs datamart

Data Warehouse	Data Mart
A Data Warehouse is a vast repository of information collected from various organizations or departments within a corporation.	A data mart is an only subtype of a Data Warehouses. It is architecture to meet the requirement of a specific user group.
It may hold multiple subject areas.	It holds only one subject area. For example, Finance or Sales.
It holds very detailed information.	It may hold more summarized data.
Works to integrate all data sources	It concentrates on integrating data from a given subject area or set of source systems.

Data Warehouse Implementation



- *Gathering the business requirement or* **Requirements analysis**: The first process in data warehousing involves defining enterprise needs, defining architectures, carrying out capacity planning, and selecting the hardware and software tools. This step will contain be consulting senior management as well as the different stakeholder.

- **Hardware integration:** Once the hardware and software has been selected, they require to be put by integrating the servers, the storage methods, and the user software tools.

- **Modeling:** Modelling is a significant stage that involves designing the warehouse schema and views. This may contain using a modeling tool if the data warehouses are sophisticated.

- **Physical modeling or selecting OS and selecting the database software:** For the data warehouses to perform efficiently, physical modeling is needed. This contains designing the physical data warehouse organization, data placement, data partitioning, deciding on access techniques, and indexing. The operating system and software also to be decided properly based on the requirements.
- **Sources:** The information for the data warehouse is likely to come from several data sources. This step contains identifying and connecting the sources using the gateway, ODBC drives, or another wrapper.
- **ETL:** The data from the source system will require to go through an ETL phase. The process of designing and implementing the ETL phase may contain defining a suitable ETL tool vendors and purchasing and implementing the tools. This may contains customize the tool to suit the need of the enterprises.

- **Populate the data warehouses:** Once the ETL tools have been agreed upon, testing the tools will be needed, perhaps using a staging area. Once everything is working adequately, the ETL tools may be used in populating the warehouses given the schema and view definition.
- **User applications and select the end user tools:** For the data warehouses to be helpful, there must be end-user applications and tools. This step contains designing and implementing applications required by the end-users.
- **Roll-out the warehouses and applications:** Once the data warehouse has been populated and the end-client applications tested, the warehouse system and the operations may be rolled out for the user's community to use.
- **Data Warehouse Readiness Assessment** examines the state of an organization relative to the delivery of data warehouse solutions