<u>Chapter - 3</u>
<u>Advanced Database Technologies</u>

DATA WAREHOUSE AND DATA-MINING

<u>Definition</u>

The term data warehouse was coined with the definition of Inmon**: "A warehouse is a** subject-oriented, integrated, time variant **and** non-volatile **collection of data in support of management's decision making process" .**

<u>Characteristics of DW</u>

- ***Subject-oriented :*** Means that all relevant data about a subject is gathered and stored as a single set in a useful format. Information is presented according to specific subjects or areas of interest.

- ***Time-variant :*** Means that the data warehouse contains a history of the subject, as well as current information. It may be long-term data from five to ten years in contrast to the 30 to 60 day time..

- ***Non-volatile :*** Means stable information, Information is consistent; Data in the database is never over-written or deleted once committed.

- ***Integrated :*** Stored in a globally acceptable fashion with consistent naming conventions, measurements, encoding structures, and physical attributes, *though underlying operational systems store the data differently;*

<u>Data Warehouse Architecture:</u>

- **Warehouse database server:**
  Which is almost always a relational DBMS; rarely flat files.

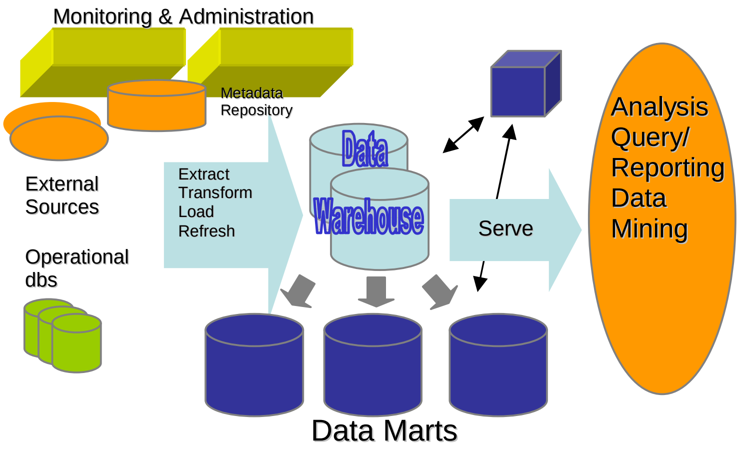
- **OLAP servers:-** Which may either be a ROLAP or MOLAP
  - *Relational OLAP (ROLAP):* **Extended relational DBMS that maps operations on multidimensional data to standard relational operations.**
  - *Multidimensional OLAP (MOLAP*)**: Special purpose server that directly implements multidimensional data and operations.**

- **Clients:-**The Users or the client of Data warehouses are various Query and reporting tools, Analysis tools and Data mining tools (e.g., trend analysis, prediction)

<u>Processors in Datawarehouse server</u>

- **MPP**
  - **Massively parallel processing, a computer configuration that is able to use hundreds or thousands of CPUs simultaneously.**

- **SMP**
  - **Symmetric multi-processing is a computer configuration where many CPUs share a common operating system, main memory and disks. They can work on different parts of a problem at the same time.**



OLAP Vs OLTP

	OLTP	Data Warehouse (DW)
Type of Users	Clerk, IT Professional	Knowledge worker
Purpose	Day to day operations	Decision support
DB Model	Application-oriented (E-R based)	Subject-oriented (Star, snowflake)
Data	Current, Isolated	Historical, Consolidated
View	Detailed, Flat relational	Summarized, Multidimensional
Usage	Structured, Repetitive	Ad hoc
Unit of work	Short, Simple transaction	Complex query
Access Operations	Read/write	Read Mostly
No. of Users	Tens	Millions
Data base size	Thousands, 100 MB-GB	Hundreds, 100GB-TB

Steps involved in creating a Datawarehouse

- ***Data extraction***
- ***Data cleaning***, also called *data cleansing* or *scrubbing*,
- ***Data transformation***
- ***Convert from legacy/host format to warehouse format***
- ***Load***
- ***Sort, summarize, consolidate, compute views, check integrity, build indexes, partition***
- ***Refresh***
- ***Propagate updates from sources to the warehouse***

Advantages

- Data warehouses enhance end-user access to a wide variety of data.
- Decision support system users can obtain specified trend reports, e.g. the item with the most sales in a particular area within the last two years.
- Data warehouses can be a significant enabler of commercial business applications.

Data Mining

- **Definition**
  - Data mining, ***the extraction of hidden predictive information from large databases***
  - ***The nontrivial extraction of implicit, previously unknown, and potentially useful information from data" and "the science of extracting useful information from large data sets or databases".***

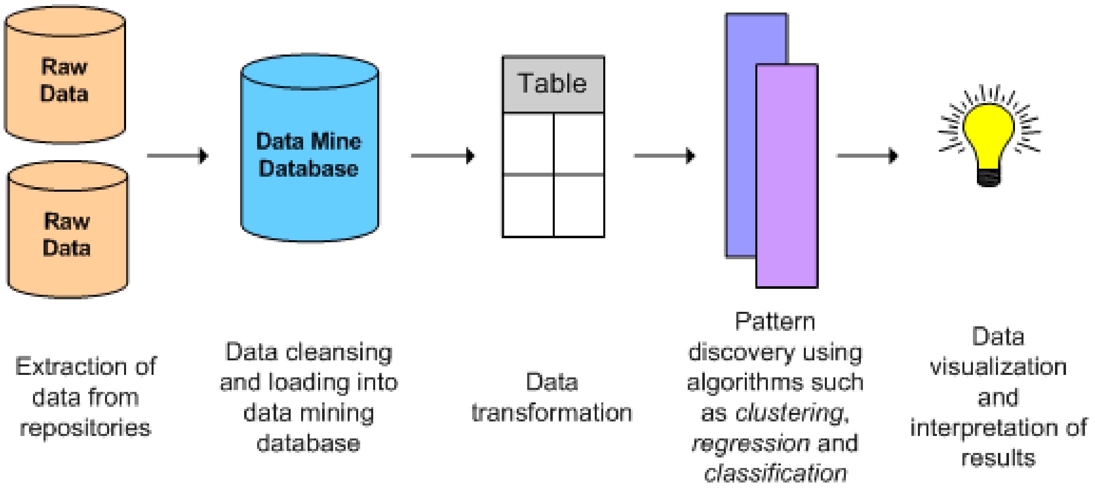
Techniques used in Data Mining: -

Artificial neural networks
Genetic algorithms
Decision trees
Nearest neighbor method
Rule induction

Evolution of Datamining

Evolutionary Step	**Enabling Technologies**	**Characteristics**
Data Collection (1960s)	Computers, tapes, disks	Retrospective, static data delivery
Data Access (1980s)	Relational databases (RDBMS), (SQL), ODBC	Retrospective, dynamic data delivery at record level
Data Warehousing & Decision Support (1990s)	On-line analytic processing (OLAP), multidimensional databases, data warehouses	Retrospective, dynamic data delivery at multiple levels
Data Mining (Emerging Today)	Advanced algorithms, multiprocessor comp, massive databases	Prospective, proactive information delivery

Steps involved in Data mining process


Raw Data
Raw Data
Data Mine Database
Table
Extraction of data from repositories
Data cleansing and loading into data mining database
Data transformation
Pattern discovery using algorithms such as *clustering*, *regression* and *classification*
Data visualization and interpretation of results

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