INTRODUCTION TO BUSINESS INTELLIGENCE

Unit: 1

Business Intelligence and Data Visualization
(ACSAI0519)

Course Details
(B Tech 5th Sem)

Ruchika
Assistant professor
CSE-AI

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Evaluation Scheme

- B. Tech (IOT)
- 5th Semester
- Professional Course

BUSINESS INTELLIGENCE AND DATA VISUALIZATION

L T P	Credits
3 – 0– 0	3

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Course objective

B. TECH. (AI)			
Course code		**L T P** **3 0 0**	**Credits** **3**
Course title	Business intelligence and Data visualization		
Course objective:			
This course covers fundamental concepts of Business Intelligence tools, techniques, components and its future. As well as a bit more formal understanding of data visualization concepts and techniques. The underlying theme in the course is feature of Tableau, its capabilities.			

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Course Syllabus

Course Contents / Syllabus		
UNIT-I	**Introduction To Business Intelligence**	**8 Hours**
Business Intelligence (BI), Scope of BI solutions and their fitting into existing infrastructure, BI Components and architecture, BI Components, Future of Business Intelligence, Functional areas of BI tools, End user assumptions, setting up data for BI, Data warehouse, OLAP and advanced analytics, Supporting the requirements of senior executives including performance management, Glossary of terms and their definitions specific to the field of BI and BI systems.		

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Course Outcomes

Course outcomes : After completion of this course students will be able to		
CO 1	Apply quantitative modelling and data analysis techniques to the solution of real-world business problems	K1, K2
CO 2	Understand the importance of data visualization and the design and use of many visual components	K2
CO 3	Understand as products integrate defining various analytical process flow.	K2
CO4	Learn the basics of troubleshooting and creating charts using various formatting tools.	K3, K4
CO 5	Learn basics of structuring data and creating dashboard stories adding interactivity dashboard stories.	K5, K6

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Previous Year Question Paper

Printed Page:- Subject Code:- ACSAI0519

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech.

SEM: V - THEORY EXAMINATION (2022 - 2023)

Subject: Business Intelligence and Data Visualization

Time: 3 Hours Max. Marks: 100

General Instructions:

IMP: Verify that you have received the question paper with the correct course, code, branch etc.

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.
2. Maximum marks for each question are indicated on right -hand side of each question.
3. Illustrate your answers with neat sketches wherever necessary.
4. Assume suitable data if necessary.
5. Preferably, write the answers in sequential order.
6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION A 20

1. Attempt all parts:-

1 KPI stands for? (CO1) 1

(a) Key Performance Indicators
(b) Key Performance Identife
(c) Key Processes Identifer
(d) OBIEE

1 _____ is a system where operations like data extraction, transformation and loading operations are executed (CO1) 1

(a) Data staging
(b) Data integration
(c) ETL
(d) Can not say

1 Data Visualisation is the component of (CO2) 1

(a) Business Intelligence
(b) RDBMS

(c) OLAP
(d) None of these

1 What is NumPy? (CO2) 1

(a) BI tool
(b) Map
(c) Charts
(d) Python Library

1 Tableau File Extension is_____ (CO3) 1

(a) twbx
(b) twby
(c) twbw
(d) twbz

1 What is SQL? (CO3) 1

(a) language
(b) Datasource filters
(c) database
(d) commands

1 What are the benefits of data visualization? (CO4) 1

(a) Better analysis
(b) Identifying patterns
(c) Exploring business insights
(d) All of the above

1 What are the functions of Data Mining? (CO4) 1

(a) Association and correctional analysis classification
(b) Prediction and characterization
(c) Cluster analysis and Evolution analysis
(d) All of the above

1 What is the recommend method to share your reports? (CO5) 1

(a) Publish them to the Power BI service
(b) Create a PDF of the report, and share the PDF with others
(c) Copy the .PBIX file to a file folder, and give coworkers access to that folder

(d) None

1 What is the SQL command to return the values from a table? (CO5) 1

(a) SELECT
(b) WHERE
(c) DISTINCT
(d) ORDER BY

2. Attempt all parts:-

2.a. What is the difference between data, information and knowledge? (CO1) 2

2.b. Define BI Reporting (CO2) 2

2.c. State some ways to improve the performance of Tableau. (CO3) 2

2.d. Explain an outlier. How would you address outliers? (CO4) 2

2.e. Define Power BI Desktop. (CO5) 2

SECTION B 30

3. Answer any five of the following:-

3 Describe the process of knowledge creation. (CO1) 6

3 What are the major applications of Power BI? Explain each one of them in detail. CO1) 6

3 Explain difference between Dashboard and Reports (CO2) 6

3 Describe data exploration? Explain its compatibilty with drill down procedure. (CO2) 6

3.e. Write the differences between Tableau and MS Excel with respect to designing. (CO3) 6

3.f. Why is it important for data scientists to focus on storytelling and presentation skills? Justify your answer with example. (CO4) 6

3.g. How to sort data in Power BI and what types of sorting used in power BI. (CO5) 6

SECTION C 50

4. Answer any one of the following:-

4 What are the critical components of the Power BI toolkit? Explain in detail. (CO1) 10

4 Describe data modeling explain with example. (CO1) 10

5. Answer any one of the following:-

5 How to build a successful Business Intelligence strategy? Write step by step procedure of it. (CO2) 10

5 Difference between Business Intelligence and Business Analytics with an example. (CO2) 10

6. Answer any one of the following:-

Previous Year Question Paper

6	Describe Manupulating of data in Tableau in detail. (CO3)	10
6	State some ways to improve the performance of Tableau. What is the difference between published data and embedded data sources in Tableau? (CO3)	10
7. Answer any one of the following:-		
7	Explain the process of exporting a file in Tableau. Write the step by step Procedure. (CO4)	10
7	Describe infographics in detail Why it used for Data Storytelling justify your answer with example. (CO4)	10
8. Answer any one of the following:-		
8	Elaborate Forecast in Power BI. (CO5)	10
8	How would you gather dashboard requirements from stakeholders? (CO5)	10

Printed Page:- 04 **Subject Code:- ACSAI0519**

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B.Tech

SEM: V - THEORY EXAMINATION DEC - 2023

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SECTION A **20**

1. Attempt all parts:-

1-a. Choose from the following which does not form part of BI Stack in SQL Server (CO1) 1

(a) SSIS
(b) OBIEE
(c) SSAS
(d) None

1-b. _____ is a category of applications and technologies for presenting and analyzing corporate and external data. (CO1) 1

(a) EIS
(b) MIS
(c) Data warehouse
(d) Decision power

1-c. NumPy is_____(CO2) 1

(a) BI tool
(b) Map
(c) Charts
(d) Python Library

1-d. _____ is a system where operations like data extraction, transformation and loading operations are executed.(CO2) 1

(a) Data staging
(b) Data integration
(c) ETL
(d) None of the above

1-e. Dimension in TABLEAU is (CO3) 1

(a) A measure that is computed based on the values of one or more dimensions
(b) A column in a data source that contains categorical data
(c) A data type used to represent numerical values
(d) A type of join used to combine data from multiple tables

1-f. The type of join used in blending is _____ (CO3) 1

(a) NONE
(b) Right join
(c) LEFT join
(d) OUTER JOIN

1-g. The benefits of data visualization is (CO4) 1

(a) Better analysis
(b) Identifying patterns
(c) Exploring business insights
(d) All of the above

1-h. A ____ is a line that provides an approximation of the relationship between the variables. (CO4) 1

(a) sparkline
(b) gridline
(c) trendline
(d) None of these

1-i. A function that can only work on numeric fields is_____.(CO5) 1

(a) ISNUMBER

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Previous Year Question Paper

(b) AVERAGE
(c) AND
(d) CONCATENATE

1-j. The expression used to indicate the table where the values would be searched from is _____ (CO5) 1

(a) WHERE
(b) FROM
(c) TABLE
(d) SELECT

2. Attempt all parts:-

2.a. Discuss the advantages of making decision using business intelligence over making decision without business intelligence.(CO1) 2

2.b. Define Software Development Kit(SDK). (CO2) 2

2.c. Enlist the various data file formats in TABLEAU.(CO3) 2

2.d. Write down the steps to publish visualization in TABLEAU online.(CO4) 2

2.e. Elaborate about Workspace in Power BI.(CO5) 2

SECTION B **30**

3. Answer any five of the following:-

3-a. Explain in detail the features of Data Warehouse.(CO1) 6

3-b. Define data mining and its application in Business Intelligence.(CO1) 6

3-c. Explain Risk Mitigation with suitable diagram.(CO2) 6

3-d. Differentiate between dashboard and scorecard in detail.(CO2) 6

3.e. State some ways to improve the performance of Tableau.(CO3) 6

3.f. Discuss the various ways in which data can be manipulated in TABLEAU.(CO4) 6

3.g. Describe how the Power BI products integrate.(CO5) 6

SECTION C **50**

4. Answer any one of the following:-

4-a. Discuss the architecture and the various components of BI with help of diagram.(CO1) 10

4-b. Differentiate between BI traditional tools with Modern BI tools in detail.(CO1) 10

5. Answer any one of the following:-

5-a. Discuss the need of Business Intelligence Reporting Tools in various business with suitable examples.(CO2) 10

5-b. Discuss the various trends and technologies used in Business Intelligence.(CO2) 10

6. Answer any one of the following:-

6-a. Explain in detail the various ways to connect your data to TABLEAU.(CO3) 10

6-b. Describe the various types of charts used in TABLEAU with suitable diagrams.(CO3) 10

7. Answer any one of the following:-

7-a. Discuss in detail the steps to create a story and dashboard in TABLEAU.(CO4) 10

7-b. Explain the steps of sorting and filtering data in TABLEAU.(CO4) 10

8. Answer any one of the following:-

8-a. Discuss the Power BI ecosystem in detail.(CO5) 10

8-b. Define Power BI and its relationship with Excel in detail.(CO5) 10

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Content

- Introduction to Business Intelligence
- Business Intelligence
- Scope of Business Intelligence
- Business Intelligence Components and Architecture
- Future of Business intelligence
- Functional areas of BI tools
- Dataware House
- OLAP
- Advanced Analytics
- Business Intelligence System

Course Objective

- This course introduces data visualization theories, techniques, and tools particularly for analyzing and presenting business data. Students will design, develop, and evaluate effective visualizations and dashboards, using various development tools.
- This course focuses on how business intelligence in Tableau uses business analytics tools that make it easy to combine data from multiple sources, analyze and visualize information. It helps trainees in making more informed and better decisions to guide the business. After the completion of the course trainee will be through with all the concepts of business intelligence and Tableau.
- The objective of this course is to assist the folks in running a business strategically. One of the main objectives of this training is to train you on all the concepts that are related to business intelligence and Tableau. The purpose of the Business Intelligence using Tableau training program is to support better business decision-making. Topics like BI – Business Intelligence, Business Intelligence with Tableau, are covered in the training program.

Course Outcome

- Business intelligence (BI) is essentially the collection of tools and processes that are used to gather data and turn it into meaningful information that people can use to make better decisions. Using Excel, you can create powerful reports, scorecards, and dashboards. You can bring data into Excel, sort, and organize data, and use it to create reports and scorecards. You can also use powerful analytic capabilities in Excel to visualize and explore data. Through these tutorials, we are going to understand business intelligence and data visualization using the Tableau tool. This training will help you learn about.
- This course introduces data visualization theories, techniques, and tools particularly for analyzing and presenting business data. Students will design, develop, and evaluate effective visualizations and dashboards, using various development tools.

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CO-PO and PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1		2	2				1		1	1	1	
CO2	1	2	2	1	3	1		1	1	2	1	2	2	2	1
CO3	1	2	1	1	1	2				1	2	2		1	1
CO4	1	2			1	1			1	1	1	1	1	2	2
CO5	1	3	1	1	1		1	1				2		1	2
AVG	1.2	2	1.25	1	1.6	1.5	1	1	1	1.25	1.33	1.6	1.33	1.4	1.5

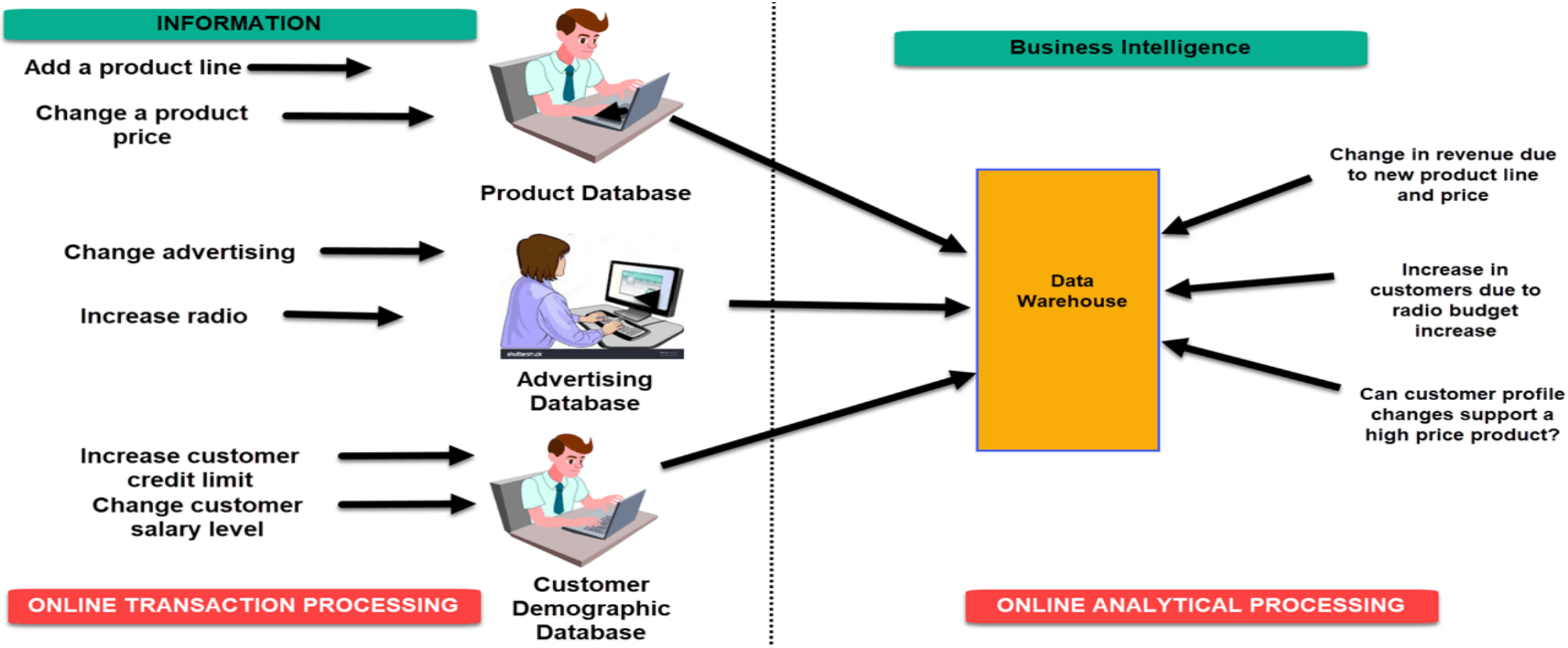
Prerequisite and Recap

- Basic Knowledge Of Business Intelligence.
- Knowledge about Data mart Data warehouse.

BUSINESS INTELLIGENCE

- BI(Business Intelligence) is a set of processes, architectures, and technologies that convert raw data into meaningful information that drives profitable business actions. It is a suite of software and services to transform data into actionable intelligence and knowledge.
- BI has a direct impact on organization's strategic, tactical and operational business decisions. BI supports fact-based decision making using historical data rather than assumptions and gut feeling.
- BI tools perform data analysis and create reports, summaries, dashboards, maps, graphs, and charts to provide users with detailed intelligence about the nature of the business.
- Business intelligence (BI) refers to the procedural and technical infrastructure that collects, stores, and analyzes the data produced by a company's activities.
- BI is a broad term that encompasses data mining, process analysis, performance benchmarking, and descriptive analytics. BI parses all the data generated by a business and presents easy-to-digest reports, performance measures, and trends that inform management decisions.

BUSINESS INTELLIGENCE



SCOPE OF BI

- Aligning processes to the business objective – BI helps detect functions, people or activities that are improperly aligned with core business objectives. This in turn helps management take immediate action and improve practices. Lean and mean is the way to go.
- Providing insights to the most difficult business problems – Quick access to large volumes of data helps extract critical facts at a rapid speed, and as they say, time is money!
- Determine patterns in customer behavior – Knowledge of customer patterns helps an enterprise know who its most valuable customers are, how to retain them and in some cases, when to let certain customers go. The better you know your target audience, the more likely you are to grow your business.
- Empower employees – BI equips businesses with the most important tool for successful decision making: real-time information! With this, every employee can make informed decisions, increasing the success rates of business processes multi-fold. Real time information helps transform effort into efficiency.

SCOPE OF BI

- Monitor the usage of companies' resources – With BI, organizations can determine the cause of loss of productivity by tracking internet usage and how much time employees spend on activities unrelated to work. Better use of resources equals better returns for the company.
- Helps in cost control – BI improves the visibility of functions like inventory management. It lowers storage and maintenance costs by preventing to in manufacturing, by maximizing production efficiency.
- Scale performers in the organization – BI helps reveal information on who the top and bottom performers are and enables one to reorganize a team to reap better returns from existing talent. It's always beneficial to let your top performers know who they are.
- Eliminate time spent on data entry –BI, when well-configured, can reduce and in some cases eliminate the time spent on data entry; time which can then be spent analyzing outcomes and making better and more informed decisions.

BUSINESS INTELLIGENCE INFRASTRUCTURE

- When you first start to implement the business intelligence technology strategy, it may be sufficient to host all your BI components on a single server. In my experience, a single powerful off-the-shelf server is preferable to several budget servers. I make this point because hardware virtualization enables server administrators to deploy server instances with a lower specification than a modern laptop. These small servers are not appropriate for BI development.

  BI tools are resource hungry – we measure their efficiency in person-hours and business value, not CPU cycles.
- The resource utilization pattern of BI is different from operational systems. The server will either be 80%+ utilized or not at all. It is common to schedule ETL jobs overnight, regular report processing in the early morning, with ad hoc querying and analytics running during the day. With server utilization staggered over the course of the day, it makes sense that each discrete process has access to all the available hardware resources We will consider these in the sub sections below.

BUSINESS INTELLIGENCE INFRASTRUCTURE

ONLINE ANALYTICAL PROCESSING (OLAP)

- OLAP analyzes business information in a multi-dimensional manner to assist with complex calculations, trend analysis, and data modeling. With OLAP, the end-user gets an opportunity to analyze specific data in multiple dimensions to obtain the necessary insight for making a decision.
- Businesses are constantly bringing information together to perform different analysis. They have a sharp need to get all the data in one place to achieve an accurate and reliable understanding of different aspects of the data. OLAP can help them achieve just that: get quick access to multi-dimensional analysis results.
- This technology stands behind the majority of business intelligence applications. It deals with data discovery as well as capabilities for report viewing, complex calculations for analytics, and assistance with “what if” scenario planning

BUSINESS INTELLIGENCE INFRASTRUCTURE

CORPORATE PERFORMANCE MANAGEMENT

- Corporate Performance Management (CPM) encompasses methods, metrics, activities, and systems, which are used to monitor and manage the business performance of a company. CPM software processes the focused information to turn it into operational plans.
- This process and methodology offer business owners an integrated approach to planning, forecasting for finance, sales, marketing, HR, and operations. When this methodology is implemented, it joins company strategies with plans and executions, thus helping a business succeed and improve.
- CPM is an important component of business intelligence for companies that are looking for such changes as budget remodeling, cost-cutting, upgrading organization strategy, better KPIs alignment, and improving the process of financial planning.

BUSINESS INTELLIGENCE INFRASTRUCTURE

REAL-TIME BUSINESS INTELLIGENCE

- Real-time business intelligence (RTBI) is used when sorting, and analyzing business data and operations have to be done at the collection stage. Real-time BI allows the company to get insights into the business process as quickly as possible to take strategic action.
- This BI component is demanded when live business insight is required, which is not a rarity in the fast-paced environment of some industries.
  RTBI is becoming especially popular in fast-paced modern society. Using software designed for RTBI, a company can create quick responses to real-time trends over email, apps, messengers, etc.

- For example, RTBI can help create special offers at the most suitable time possible to get the highest conversion rate. Another example is limited-time specials for restaurants or supermarkets that have to do with perishable products and high demands at certain times of the day. All of the above can be done while the client is on the website and near one of the company's physical locations.

BUSINESS INTELLIGENCE INFRASTRUCTURE

DATA WAREHOUSING

- Data warehousing allows the business owner to go through different data subsets and examine components that could help make the right business decisions. For example, warehousing gives a user an opportunity to monitor certain sales information collected on Mondays for the past 50 weeks.
- It helps create important statistics about the business and the industry. Warehousing implies storing formidable amounts of data in numerous special ways, which could be useful for analysis.
- Different technologies exist to help the user take advantage of data warehousing quickly and effectively.

BUSINESS INTELLIGENCE INFRASTRUCTURE

DATA SOURCES

For the business intelligence process and methodology to be integrated, it is important to have the right understanding of the data sources. Pulling raw data from different sources, internal and external is vital to the diverse analysis options.

Companies tend to store huge amounts of operational data. BI needs to navigate between the data sources. In most companies, mainframe legacy systems create a foundation for the data centers because they can deal with large volumes of data. However, such data is usually difficult to procure since many legacy apps are often obsolete or proprietary.

BUSINESS INTELLIGENCE INFRASTRUCTURE

BUSINESS INTELLIGENCE OFFERS SOLUTIONS SUCH AS THE FOLLOWING

SPEED. BI tools can provide the requested data in the shortest amount of time, often in real-time. The value of business-related information often depends entirely on speed.

RELIABILITY. The quality of information collected with BI tools is reliable but only when the right components are used. Important information can be obtained in small fragments, analyzed, and evaluated to provide value.

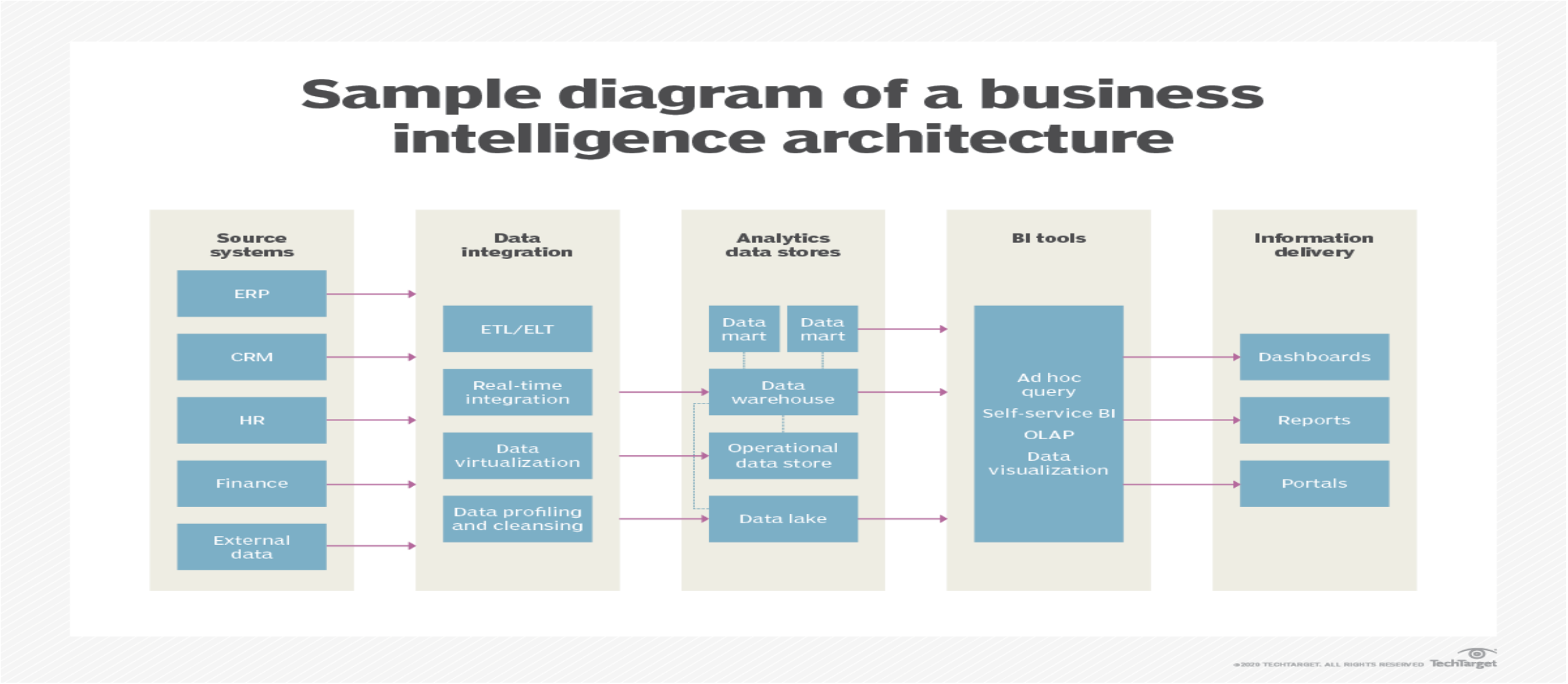
COMBINATION. The ability to find answers to complex questions based on processing smaller pieces of information. The system can offer a high degree of abstraction if necessary to build a solid model data.

BUSINESS INTELLIGENCE INFRASTRUCTURE

NAVIGATION. The ability to find the right information at the right time and the right place. BI allows navigating through data to identify the necessary pieces for analysis.

PRESENTATION. The better the BI system performs, the fewer effort is required from the user to interpret the information to assist with decision-making. The speed of the BI results depends on the presentation accuracy.

BUSINESS INTELLIGENCE INFRASTRUCTURE



BUSINESS INTELLIGENCE INFRASTRUCTURE

As shown in the accompanying business intelligence architecture diagram.

- Source systems. These are all of the systems that capture and hold the transactional and operational data identified as essential for the enterprise BI program -- for example, ERP, CRM, finance, manufacturing and supply chain management systems. They can also include secondary sources, such as market data and customer databases from outside information providers. As a result, both internal and external data sources are often incorporated into a BI architecture.
- Important criteria in the data source selection process include data relevancy, data currency, data quality and the level of detail in the available data sets. In addition, a combination of structured, semi structured and unstructured data types may be required to meet the data analysis and decision-making needs of executives and other business users.

BUSINESS INTELLIGENCE INFRASTRUCTURE

- **DATA INTEGRATION AND CLEANSING TOOLS.** To effectively analyze the data collected for a BI program, an organization must integrate and consolidate different data sets to create unified views of them. The most widely used data_integration technology for BI applications is extract, transform and load (ETL) software, which pulls data from source systems in batch processes. A variant of ETL is extract, load and transform (ELT), in which data is extracted and loaded as is and transformed later for specific BI uses. Other methods include real-time data integration, such as change data capture and streaming integration to support real-time analytics applications, and data virtualization, which combines data from different source systems virtually.

BUSINESS INTELLIGENCE INFRASTRUCTURE

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BUSINESS INTELLIGENCE INFRASTRUCTURE

The Future of Business Intelligence

Business intelligence software is rapidly developing as it becomes a necessity for many modern companies. The future of BI sees an increase in features that enable ease of use, streamlined workflows and predictive abilities.

Collaboration	Business intelligence tools will become more collaborative, facilitating teamwork.
Integration	Third-party systems will be increasingly intertwined with BI, simplifying data processing and reacting to actionable insights.
Machine Learning	Artificial intelligence analyzes past data to provide insight and forecasting.
Data Proactivity	Proactivity-focused features will respond automatically to inquiries and bring relevant data to users.
Network Advancements	Technology infrastructure will expand to store large amounts of data and better support business intelligence systems.
Data-Driven Culture	Adopting a data-driven culture involves giving all employees the resources to incorporate BI into everyday processes.

source: SelectHub

TYPES OF BI TOOLS

We know we said there are about six million ways to use BI, but we didn't want to list ALL of them. Just like there are different types of business intelligence systems, there are plenty of different ways to apply them. You'd probably get tired before finishing the full list. So we shortened it down to a much more manageable 101 examples, which you can peruse to find some of the best uses of BI systems.

- Schedule regular automated reports
- Automatically share reports with clients
- Visualize inventory and sales in real time
- Pull data from multiple databases
- Analyze ecommerce sales in real time
- Integrate with cloud computing services like AWS
- Pull and analyze data from a CRM
- Data mining for deep layers of analytics
- Create embedded dashboards in a separate internal system

TYPES OF BI TOOLS

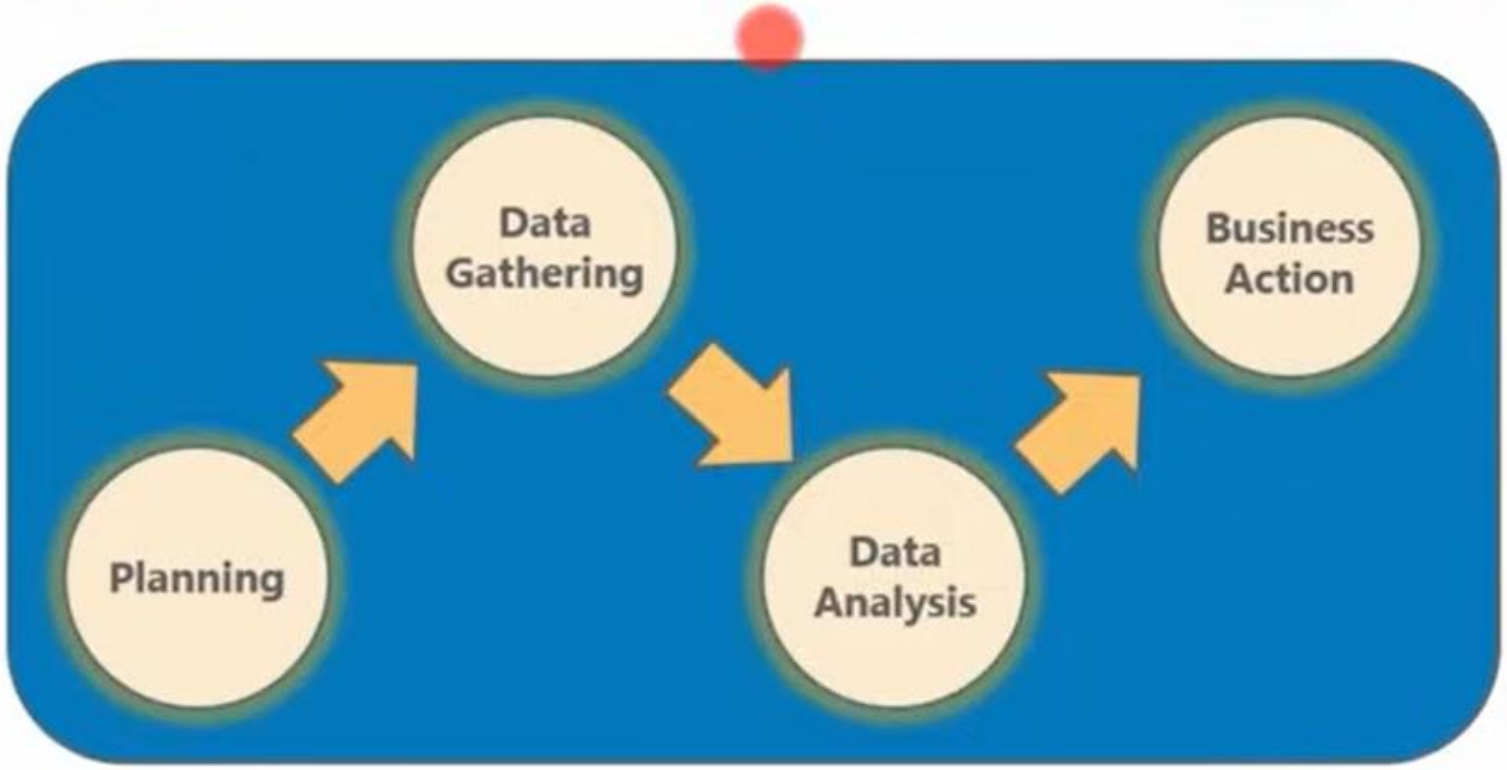
- Provide historical analysis on payroll, benefits and other employee HR data
- Embed and/or generate professional reports for clients
- Create predictive analytics dashboards and data visualizations
- Transform various types of data into a standardized format
- Predict trends using data forecasting to help with loss prevention efforts
- Assess distribution statuses on-the-go with a mobile device
- Visualize supply chain data over time
- Analyze the results of your marketing efforts both over time and in real time
- Optimize employee scheduling based on your highest and lowest foot traffic times
- Analyze commonalities in routes for various truck types, bridge weight ratings, and more

BUSINESS INTELLIGENCE FUNCTIONS

- Data Grid Cache Map-Reduce for Business Intelligence
- Data Integration Software
- Data Illustration Software
- Data Management Implementation
- Data Management Implementation Strategies
- Data Management Technology
- Data Management Tools for Better Solutions
- Data Mashup Benefits
- Data Mashup Comparison
- Data Processing Software
- Definition of Enterprise Intelligence

Why Business Intelligence ?

Business Intelligence is the activity which contributes to the growth of any company.



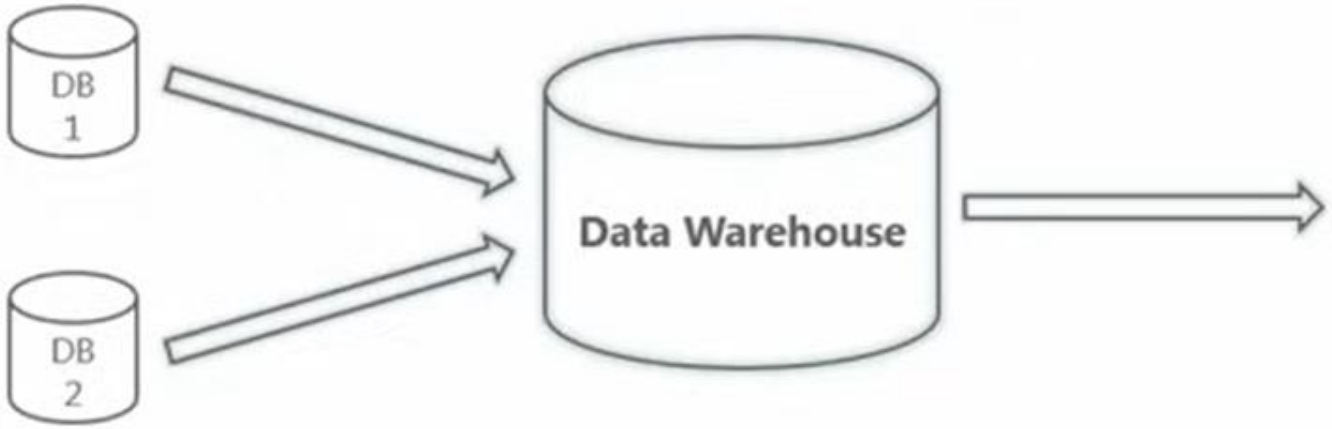
Business Growth

What is Business Intelligence ?

BI is the act of transforming raw/ operational data into useful information for business analysis.

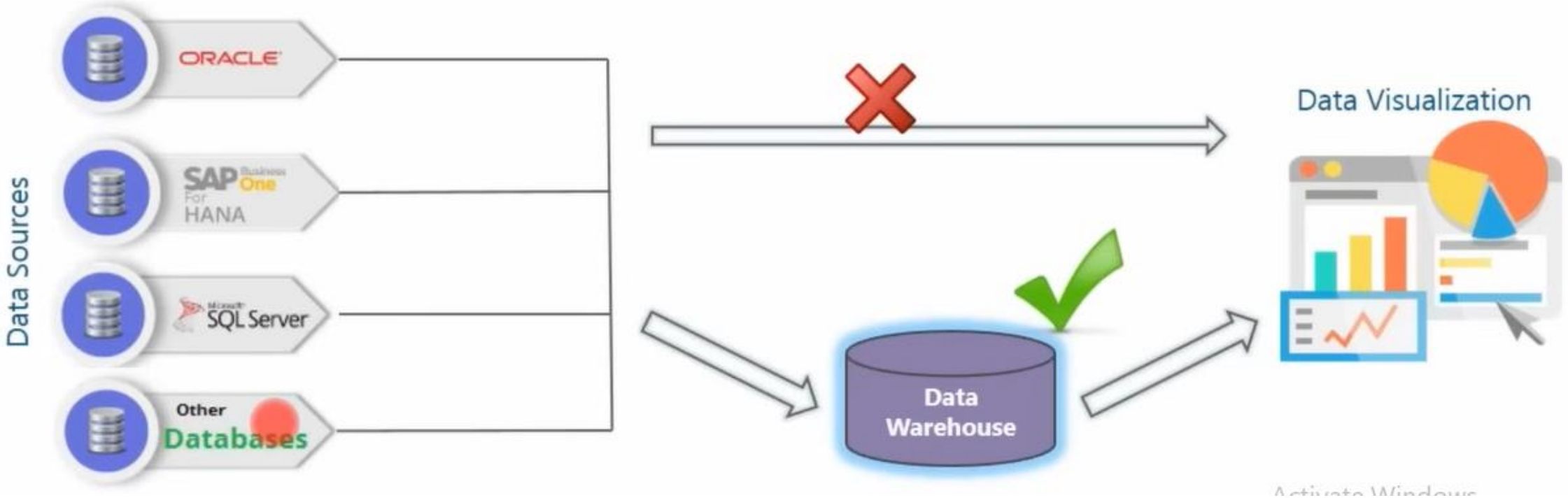
How Does It Work?

1. BI based on Data Warehouse technology **extracts** information from a company's operational systems.
2. The data is **transformed** (*cleaned and integrated*), and **loaded** into Data Warehouses.
3. Since this data is credible, it is used for business insights.



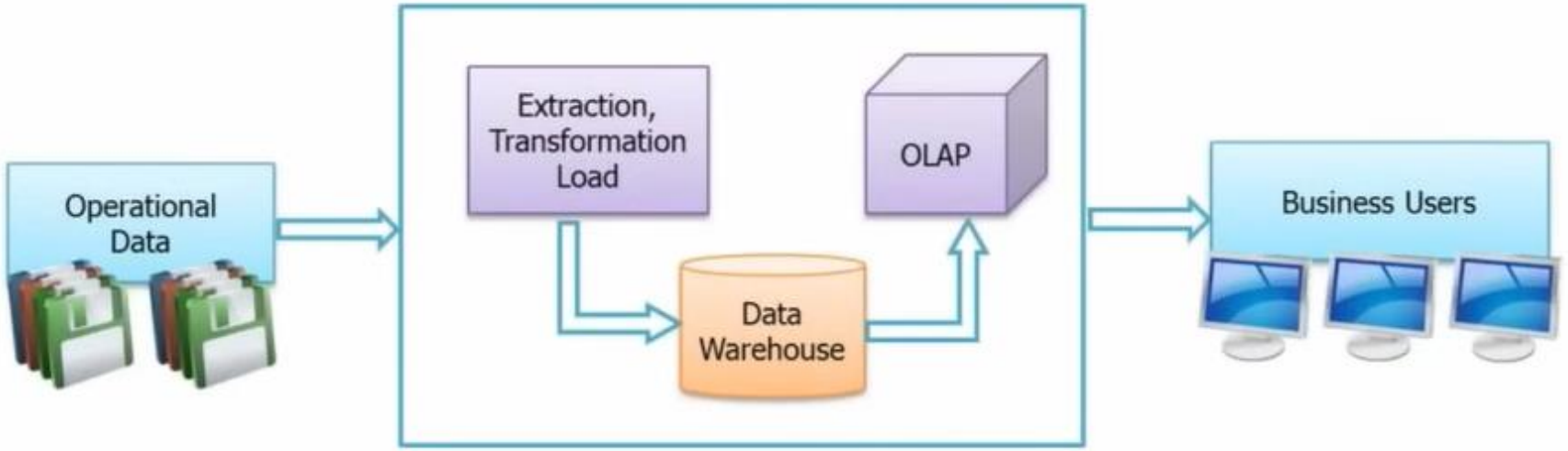
Why is Data Warehouse ?

- Data collected from various sources & stored in various databases cannot be directly visualized.
- The data first needs to be **integrated** and then **processed** before visualization takes place.



What is Data Warehouse ?

- A central location where consolidated data from multiple locations (databases) are stored.
- DWH is maintained separately from an organization's operational database.
- End users access it whenever any information is needed.
- **Note**:- Data Warehouse is not loaded every time new data is added to database.

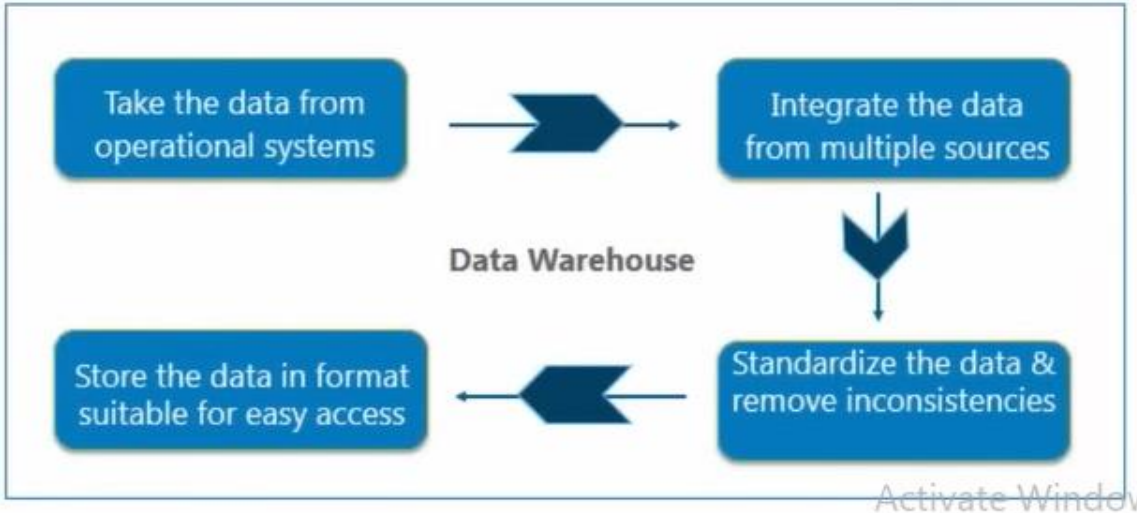


What are advantages of Data Warehouse ?

- Strategic questions can be answered by studying trends.
- Data Warehousing is faster and more accurate.
- **Note**:- Data Warehouse is not a product that a company can go and purchase, it needs to be designed & depends entirely on the company's requirement.

Query

Result



Properties of Data Warehouse

*"A Data Warehouse is a **subject-oriented**, **integrated**, **time-variant** and **nonvolatile** collection of data in support of management's decision-making process." -Bill Inmon, Father of Data Warehousing*

Subject-oriented

Data is categorized and stored by business subject rather than by application.

Integrated

Data on a given subject is collected from disparate sources and stored in a single place.

Time-variant

Data is stored as a series of snapshots, each representing a period of time.

Non-volatile

Typically data in the data warehouse is not updated or deleted.

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Information Systems: OLTP (DB) vs OLAP (DWH)

Relational Database (OLTP)	Analytical Data Warehouse (OLAP)
Contains current data	Contains historical data
Useful in running the business	Useful in analyzing the business
Based on Entity Relationship Model	Based on Star, Snowflake and Fact Constellation Schema
Provides primitive and highly detailed data	Provides summarized and consolidated data
Used for writing data into the database	Used for reading data from the data warehouse
Database size ranges from 100 MB to 1 GB	Data Warehouse size ranges from 100 GB to 1 TB
Fast; provides high performance	Highly flexible; but not fast
Number of records accessed is in tens	Number of records accessed is in millions
Ex: All bank transactions made by a customer	**Ex**: Bank transactions made by a customer at a particular time.

Information Systems: OLTP (DB) vs OLAP (DWH)

OLTP Examples:

1. A supermarket server which records every single product purchased at that market.
2. A bank server which records every time a transaction is made for a particular account.
3. A railway reservation server which records the transactions of a passenger.

OLAP Examples:

1. Bank Manager wants to know how many customers are utilizing the ATM of his branch. Based on this he may take a call whether to continue with the ATM or relocate it.
2. An insurance company wants to know the number of policies each agent has sold. This will help in better performance management of agents.

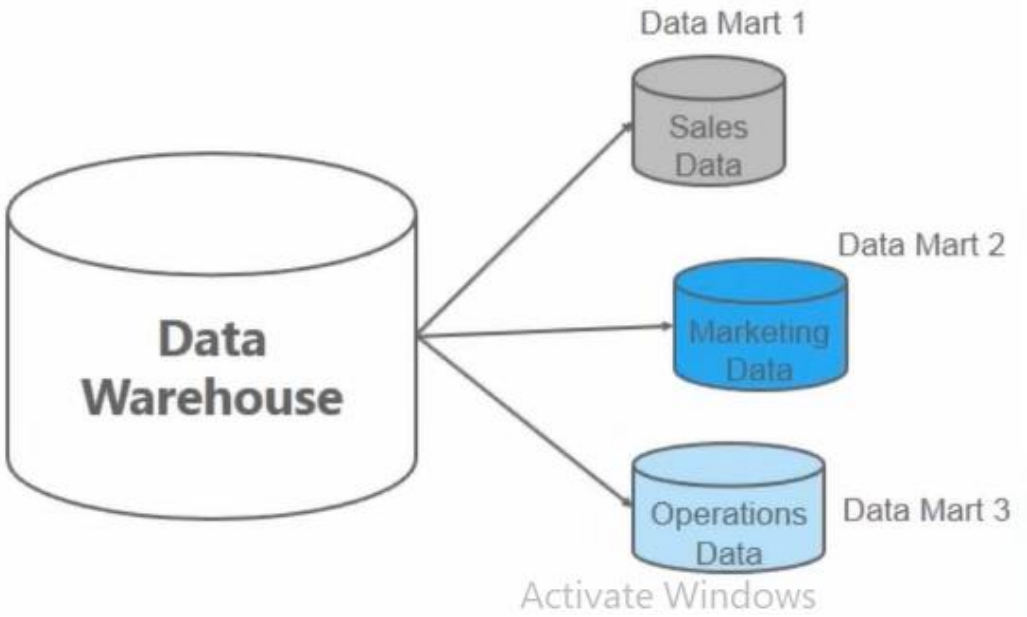
ETL -> Extract, Transform & Load

ETL is the process of extracting the data from various sources, transforming this data to meet your requirement and then loading it into a target data warehouse.

Data Mart

- Data mart is a smaller version of the Data Warehouse which deals with a single subject
- Data marts are focused on one area. Hence, they draw data from a limited number of sources
- Time taken to build Data Marts is very less compared to the time taken to build a Data Warehouse

Data Warehouse	Data Marts
Enterprise wide data	Department wide data
Multiple subject areas	Single subject area
Multiple data sources	Limited data sources
Occupies large memory	Occupies limited memory
Longer time to implement	Shorter time to implement

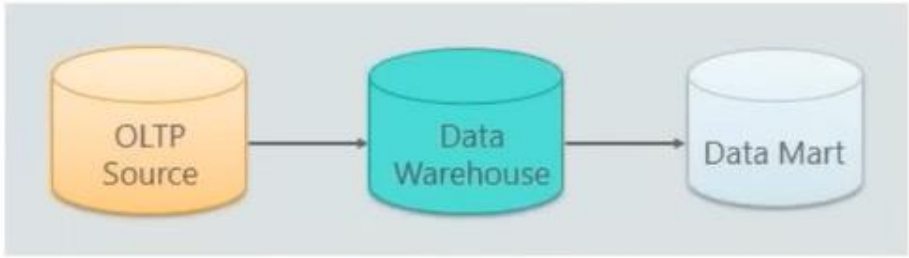


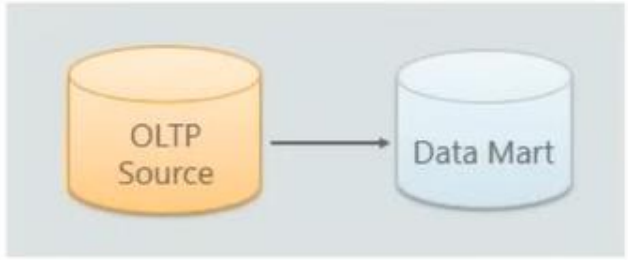
Types of Data Mart

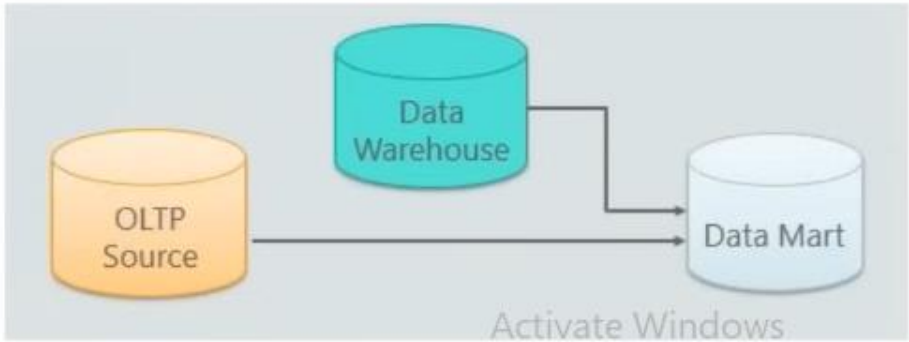
1. **Dependent Data Mart**
   - The data is first extracted from the OLTP systems and then populated in the central DWH
   - From the DWH, the data travels to the Data Mart

2. **Independent Data Mart**
   - The data is directly received from the source system
   - This is suitable for small organizations or smaller groups within an organization

3. **Hybrid Data Mart**
   - The data is fed both from OLTP systems as well as the Data Warehouse



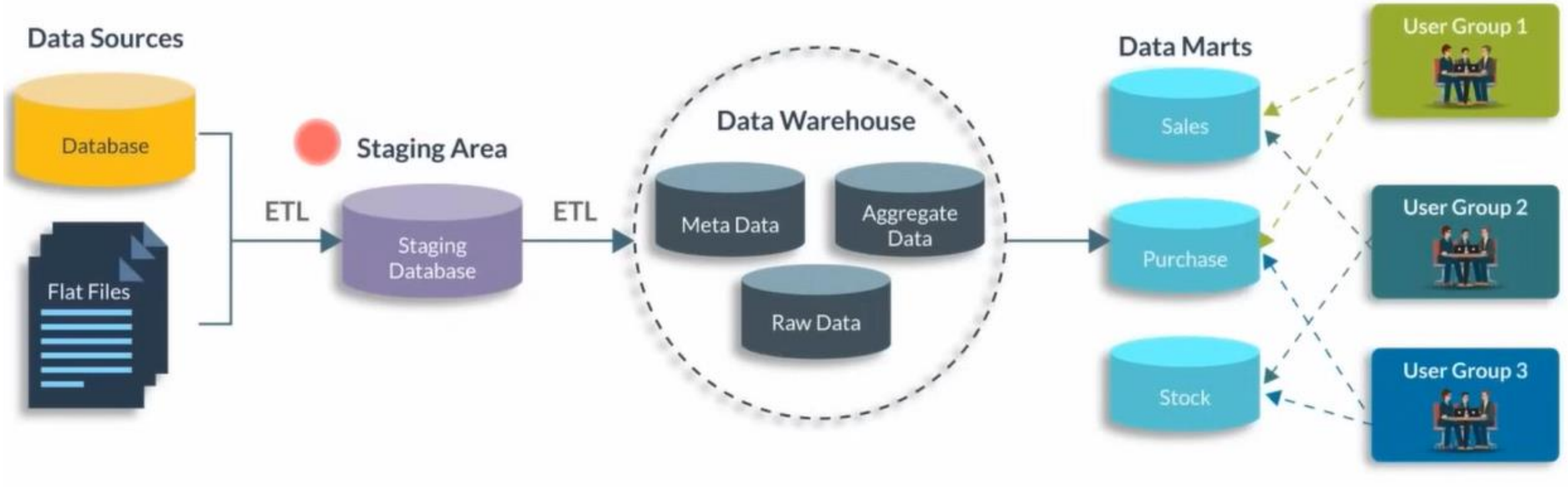




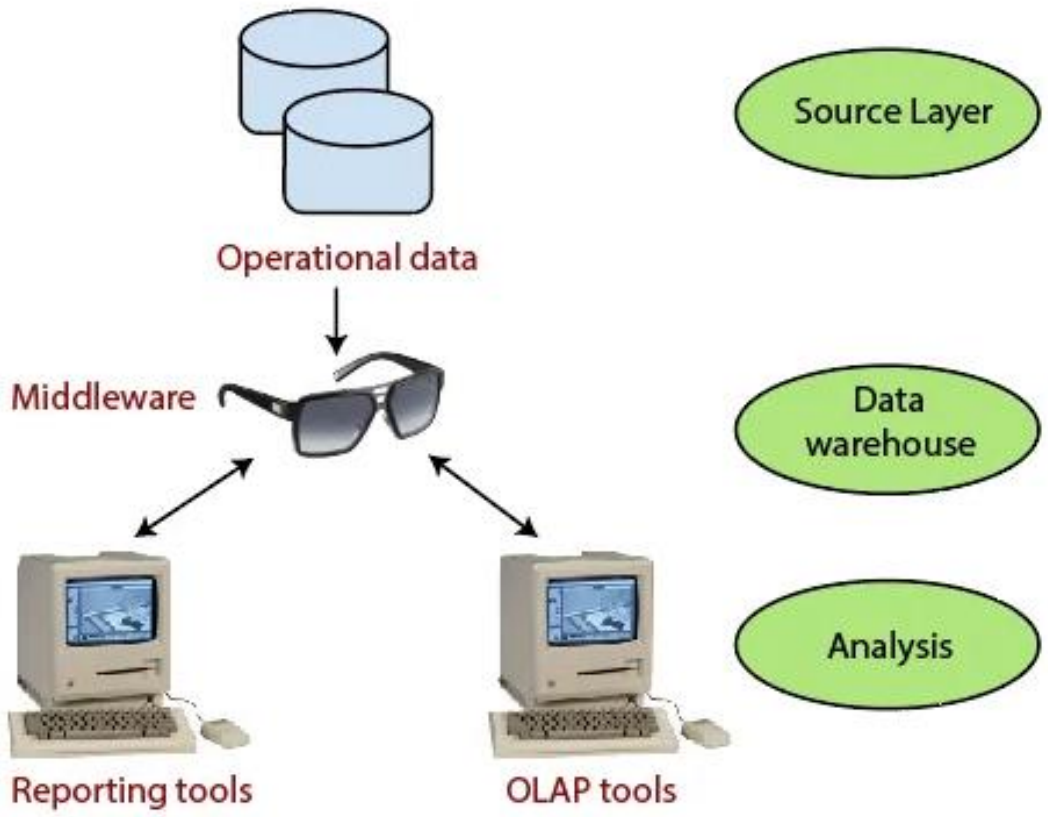
MetaData

- Metadata is defined as data about data.
- Metadata in a DWH defines the source data i.e. Flat File, Relational Database and other objects.
- Metadata is used to define which table is source and target, and which concept is used to build business logic called transformation to the actual output.

DataWare House Architechure

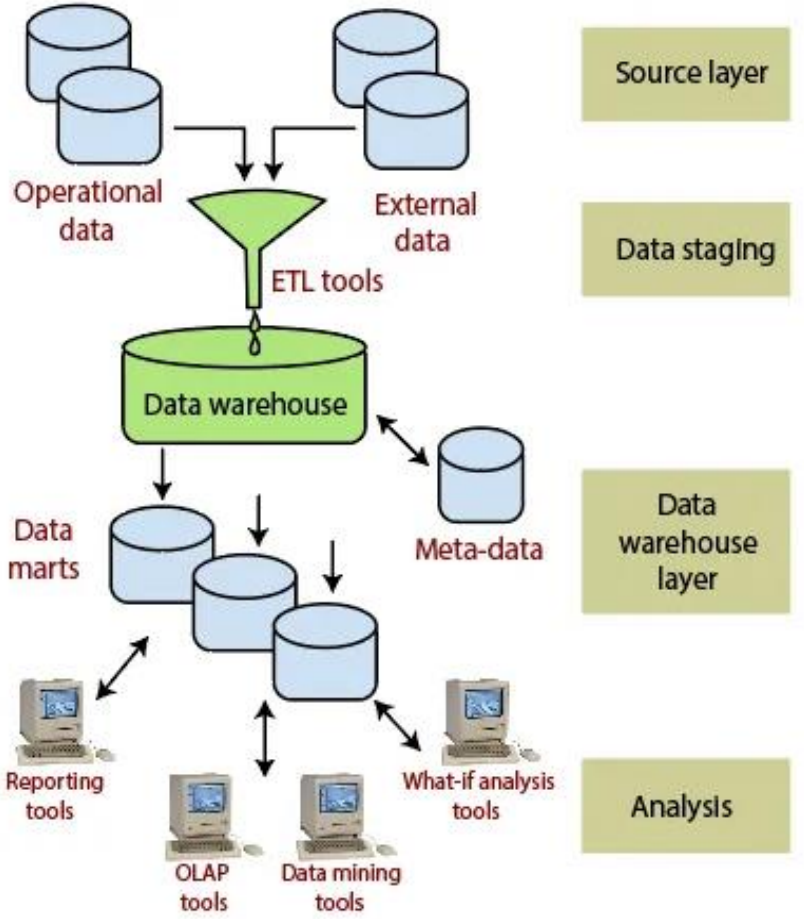


DataWare House Architechure



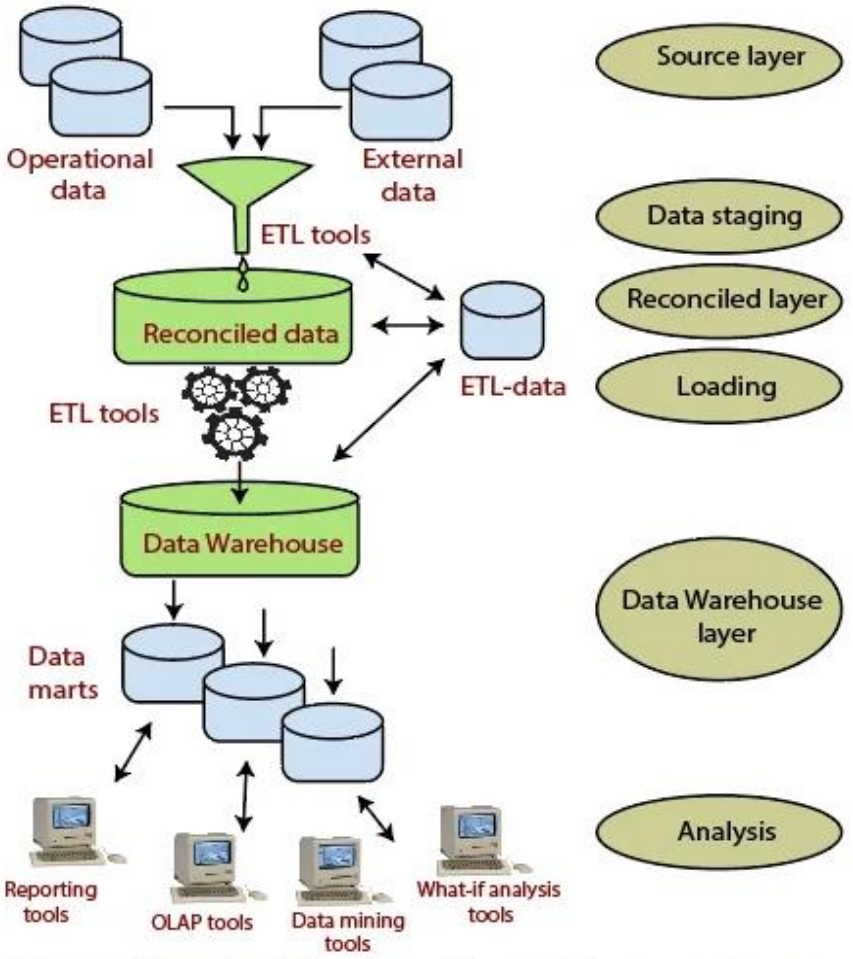
Single-Tier Data Warehouse Architecture

DataWare House Architechure



Two-Tier Data Warehouse Architecture

DataWare House Architechure



Three-Tier Architecture for a data warehouse system

DataWare House- Hands on

Problem Statement:

As a retail organization, you have details of 10,000 customer and 50,000 transactions. With this data you wish to find out Customers who have low number of purchases.

CUSTOMERS

Columns | Data | Constraints | Grants | Statistics | Triggers | Flashback | Dependencies | Details | Partitions | Indexes | SQL

Actions...

	COLUMN_NAME	DATA_TYPE	NULLABLE	DATA_DEFAULT	COLUMN_ID	COMMENTS
1	CUSTOMER_ID	VARCHAR2(5 BYTE)	No	(null)	1	(null)
2	CUSTOMER_NAME	VARCHAR2(25 BYTE)	No	(null)	2	(null)
3	CONTACT_NUMBER	VARCHAR2(15 BYTE)	Yes	(null)	3	(null)
4	EMAIL	VARCHAR2(40 BYTE)	Yes	(null)	4	(null)

TRANSACTIONS

Columns | Data | Constraints | Grants | Statistics | Triggers | Flashback | Dependencies | Details | Partitions | Indexes | SQL

Actions...

	COLUMN_NAME	DATA_TYPE	NULLABLE	DATA_DEFAULT	COLUMN_ID	COMMENTS
1	INVOICE_NO	VARCHAR2(10 BYTE)	Yes	(null)	1	(null)
2	DESCRIPTION	VARCHAR2(50 BYTE)	Yes	(null)	2	(null)
3	QUANTITY	VARCHAR2(10 BYTE)	Yes	(null)	3	(null)
4	CUSTOMER_ID	VARCHAR2(5 BYTE)	Yes	(null)	4	(null)
5	PRODUCT_ID	VARCHAR2(5 BYTE)	Yes	(null)	5	(null)

DATA WAREHOUSE

- A Data Warehouse can be viewed as a data system with the following attributes:
- It is a database designed for investigative tasks, using data from various applications.
- It supports a relatively small number of clients with relatively long interactions.
- It includes current and historical data to provide a historical perspective of information.
- Its usage is read-intensive.
- It contains a few large tables.

DATA WAREHOUSE

- Data Warehouse is a subject-oriented, integrated, and time-variant store of information in support of management's decisions."

- A data warehouse, or enterprise data warehouse (EDW), is a system that aggregates data from different sources into a single, central, consistent data store to support data analysis, data mining, artificial intelligence (AI), and machine learning. A data warehouse system enables an organization to run powerful analytics on huge volumes (petabytes and petabytes) of historical data in ways that a standard database cannot.

- Data warehousing systems have been a part of business intelligence (BI) solutions for over three decades, but they have evolved recently with the emergence of new data types and data hosting methods. Traditionally, a data warehouse was hosted on-premises—often on a mainframe computer—and its functionality was focused on extracting data from other sources, cleansing and preparing the data, and loading and maintaining the data in a relational database. More recently, a data warehouse might be hosted on a dedicated appliance or in the cloud, and most data warehouses have added analytics capabilities and data visualization and presentation tools.

OLAP

- OLAP (for online analytical processing) is software for performing multidimensional analysis at high speeds on large volumes of data from a data warehouse, data mart, or some other unified, centralized data store.
- Most business data have multiple dimensions—multiple categories into which the data are broken down for presentation, tracking, or analysis. For example, sales figures might have several dimensions related to location (region, country, state/province, store), time (year, month, week, day), product (clothing, men/women/children, brand, type), and more.
- But in a data warehouse, data sets are stored in tables, each of which can organize data into just two of these dimensions at a time. OLAP extracts data from multiple relational data sets and reorganizes it into a multidimensional format that enables very fast processing and very insightful analysis.

OLAP

- **Online Analytical Processing (OLAP)** is a category of software that allows users to analyze information from multiple database systems at the same time. It is a technology that enables analysts to extract and view business data from different points of view.
- Analysts frequently need to group, aggregate and join data. These OLAP operations in data mining are resource intensive. With OLAP data can be pre-calculated and pre-aggregated, making analysis faster.

ADVANCED ANALYTICS

- Advanced Analytics is the autonomous or semi-autonomous examination of data or content using sophisticated techniques and tools, typically beyond those of traditional business intelligence (BI), to discover deeper insights, make predictions, or generate recommendations.
- Advanced analytic techniques include those such as data/text mining, machine learning, pattern matching, forecasting, visualization, semantic analysis, sentiment analysis, network and cluster analysis, multivariate statistics, graph analysis, simulation, complex event processing, neural networks
- Advanced analytics is an umbrella term for a group of high-level methods and tools that can help you get more out of your data. The predictive capabilities of advanced analytics can be used to forecast trends, events, and behaviors. This gives organizations the ability to perform advanced statistical models such as “what-if” calculations, as well as to future-proof various aspects of their operations.
- Some of the areas that make up the magic of advanced analytics include machine learning and artificial intelligence, semantic and graph analysis, data and text mining, complex event processing, pattern matching, predictive analytics, data visualizations, sentiment analysis, network, and cluster analysis, multivariate statistics, simulation, neural networks, and the list is constantly growing as new techniques are invented and adapted to the data analytics world

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- Youtube/other Video Links
- https://www.youtube.com/watch?v=2nwgVMsf0xc
- https://www.youtube.com/watch?v=jkCCnwvO_fg
- https://www.coursera.org/lecture/business-intelligence-tools/bi-concepts-video-lecture-2arFU
- https://www.coursera.org/lecture/business-intelligence-tools/business-analytics-video-lecture-Sr8Ic

Daily Quiz

1. This is an approach to selling goods and services in which a prospect explicitly agrees in advance to receive marketing information_____

A. data mining
B. customer managed relationship
C. permission marketing
D. one-to-one marketing

2. _____defines the structure of the data held in operational databases and used by operational applications.

A. Data mining metadata
B. Operational metadata
C. Data warehouse metadata
D. User-level metadata

Daily Quiz

3. A creative _____, he was continually dreaming up new projects

A. merchant

B. trader

C. entrepreneur

D. seller

4. No one doubted that the president was a man of the highest _____

A. trait

B. entrepreneur

C. integrity

D. Demonstration

Daily Quiz

5. This is an arrangement in which a company outsources some or all of its customer relationship management functions to an application service provider (ASP).

A. Customer Information Control System
B. spend management
C. hosted CRM
D. online transaction processing

6.Their tribe is a small but _____ group.

A. intelligent
B. cohesive
C. smart
D. brutal

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Weekly Assignment

Q.1 Name Different Types Of Business Intelligence?

Q.2 Explain Data Visualization .

Q.3 Explain data warehouse .

Q.4 Explain the tools of BI.

Q.5 Explain the function of BI

Q.6 Describe a scenario where BI tools helped in making a critical business decision.

Q.7 Explain the importance of ETL processes in the BI architecture.

Q.8 Discuss the role of data warehouses in BI.

Q.9 Compare and contrast data lakes and data warehouses.

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MCQ s

1. This is a broad category of applications and technologies for gathering, storing, analyzing, and providing access to data to help enterprise users make better business decisions_____

A. Data mart
B. Data mining
C. Business intelligence
D. Artificial intelligence

2.Data warehouse architecture is based on _____

A. RDBMS
B. Sybase
C. SQL Server
D. DBMS

MCQ s

3. Record cannot be updated in _____

A. files
B. OLTP
C. RDBMS
D. data warehouse

4. The workers chose to _____ their dissatisfaction in a series of strikes.

A. face
B. confuse
C. manifest
D. create

MCQ s

5. I can catalyze a business's success in terms of_____

A. Distinguish the products and services that drive revenues
B. Rank customers and locations based on profitability
C. Ranks customers and locations based on probability
D. All of above

6.In an Internet context, this is the practice of tailoring Web pages to individual users' characteristics or preferences_____

A. customer valuation
B. customer-facing
C. Web services
D. personalization

MCQ s

7. Business intelligence is only possible with big applications like power BI_____

A. Yes, if it doesn't have a database, it's not really BI

B. No, Business intelligence means using data to support your case and displaying it in an understandable way

C. No, anything can be used as business intelligence

D. Yes, Expensive software is necessary

8. The important aspect of the data warehouse environment is that data found within the data warehouses _____

A. time-variant

B. subject-oriented

C. integrated

D. None

MCQ s

9. This is the processing of data about customers and their relationship with the enterprise in order to improve the enterprise's future sales and service and lower cost_____

A. customer relationship management

B. CRM analytics

C. database marketing

D. customer relationship management

10.This is a broad category of applications and technologies for gathering, storing, analyzing, and providing access to data to help enterprise users make better business decisions_____

A. Data mart

B. Data mining

C. Business intelligence

D. Artificial intelligence

MCQ s

11. What does ETL stand for in BI terminology?

a) Extract, Transform, Load

b) Evaluate, Test, Launch

c) Execute, Transfer, Log

d) Enhance, Transmit, Layer

12. Which BI feature is most important for senior executives focused on performance management?

- a) Real-time data visualization
- b) Social media integration
- c) Email automation
- d) Virtual reality interface

MCQ s

13. What does OLAP stand for in the context of BI?

a) Online Learning and Analytics Processing

b) Offline Learning and Analytics Processing

c) Online Analytical Processing

d) Offline Analytical Processing

14. What is the primary role of a data warehouse in a BI system?

a) To handle online transactions

b) To store large volumes of historical data for analysis

c) To manage network traffic

d) To create email campaigns

MCQ s

15. What is the first step in setting up data for Business Intelligence?

a) Creating data visualizations

b) Cleaning and preprocessing the data

c) Buying new hardware

d) Hiring a consultant

16. What is a common functional area of Business Intelligence tools?

a) Sales forecasting

b) Game development

c) Website design

d) Office supply management

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Expected Questions for University Exam

- https://www.shaalaa.com/question-paper-solution/university-of-mumbai-be-data-warehousing-mining-business-intelligence-semester-7-be-fourth-year-2014-2015-old_9

Summary

- Business intelligence uses technology, such as software programs like Excel, to analyze data and provide actionable information to help business executives make informed choices and decisions.
- BI can be applied to making both operational and strategic business decisions.
- Business intelligence is created by a team of professionals that includes data engineers, data analysts, and data visualization specialists.
- Data visualization is the representation of data through use of common graphics, such as charts, plots, infographics, and even animations. These visual displays of information communicate complex data relationships and data-driven insights in a way that is easy to understand.
- Data visualization is the visual presentation of data or information. The goal of data visualization is to communicate data or information clearly and effectively to readers. Typically, data is visualized in the form of a chart, infographic, diagram or map.

References

Thank You