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Five-Tier Business Intelligence (BI) Architecture

This section introduces to the commonly term and concepts as well as the classical five-tier architecture of a BI solution.

Abbrevations:

APIs: Application Programming Interfaces

BI: Business Intelligence

CASE: Computer Aided Software-Engineering

CDIF: Case Data Interchange Format

CLI: Call Level Interface

CWH: Common Warehouse Model

CORBA: Common Object Request Broker Archtiecture

DBMS: Database Management System

DB2 UDB: DB2 Universal Database

DC: Direct Costs

DDL: Data Definition Language

DOM: Document Object Model

DTD: Document Type Definition

DWH: Data Warehouse

ECMA: European Computer Manufacture's Association

EIA: Electronic Industries Associations

ERM: Entity-Relationship Model

ETL: Extraction Transformation Loading

ERP: Enterprise Resource Planning

GIF: Graphics Interchange Format

IDL: Interface Definition Language

IRDS: Information Resource Dictionary System

ISO: International Organization for Standardization

MDC: Meta Data Coalition

MDIS: Metadata Interchange Specification

MDL: Model Definition Language

A BI solution describes the decision-orientated collection and processing of data for presenting relevant business information for the management. They are built upon several layers, or respectively components like ETL-tools (extraction, transformation, and loading) data warehouse (DWH), reporting, online analytical processing (OLAP) and data mining. Further, a consistent BI solution has to conform with certain business and technical requirements of an enterprise, which are based on data warehousing [CBS02, page 909]:

Data integration: A BI solution integrates heterogeneous, intra and external cooperated data sources into a homogeneous environment. Furthermore, it is important to define data consistently to offer users a uniform view of integrated data sources.

Time-referenced data: Data are stored over a long period of time, because they are only valid and accurate for a specific point and period of time. Data in a BI solution are past-referenced and previous data, which represent only a "snap-shot" [CBS02, page 909].

Data constancy: It is necessary to refresh data sets from operative data systems (data resources), because data in a DWH are not updated in real time. Data sets in a BI solution are never replaced but they are supplemented with new data. Such new data sets are continuously integrated with previous data in a BI solution [CBS02, page 909.Based on this fact a BI solution provides both a granular and an aggregated data view.

Subject-orientated data: A BI solution is arranged according to a company's key processes (e.g. customers, products and sales) instead of application areas (issuing an invoice, storage or distribution) [CBS02, page 909]. Based on these requirements a BI solution provides decision-orientated accurate data sets in respond to information queries and to support decisions very quickly.

MOF: Meta Object Facility
mUML: Multidimensional UML
MS: Microsoft
OC: Overhead Costs
OCL: Object Constraint Language
ODBC: Open Database Connectivity
ODBMS: Object-Orientated Database Management System
OLAP: Online Analytical Processing
OMS: Object Management System
OOD: object-oriented design
OMG: Object Management Group
PCTE: Portable Common Tool Enviroment
RPCS: Remote Prcedure Calls
SQL: Structured Query Language
SVG: Scalable Vector Graphics
UML: Unified Modeling Language
UDFs: User Defined Functions
WWW: World Wide Web
W3C: World Wide Web Consortium
XMI: XML Meta Data Intechange
XML: Extensible Markup Language

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On the basis of these requirements, a conceptional BI solutions are built upon a five-tier architecture as shown in figure 1 and embraces different aspects across represented by a separate BI software component depending on their specific processing requirements such as data warehousing or reporting.

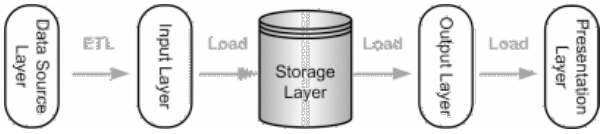

Figure 1: Five-tier architecture of a classical BI platform.

The Data Source Layer includes the available or maybe multiple data sources of a business company such as ERP systems, DBMSs or legacy systems as well as flat files. A ETL (extraction, transformation, and loading) tool in the Input Layer describes which way and what kind of transformation occurs when data items move on from their sources, through the ETL process [Cog02, page 29] to the Storage Layer or target DWH. In essence, the ETL process cleanses and consolidates the multiple data sources into a uniform organisation view. Furthermore, the input layer contains already the overall metadata-driven architecture for data warehousing and all further business analysis in the Presentation Layer. In general, the DWH in the Storage Layer represents the consolidation and aggregation of the corporation-wide and distributed data sources. It stores the extracted and transformed data of the data sources. Furthermore, it contains only historical data and thus the DWH "is designed for query and analysis rather than for transaction processing" [ORA03, Data Warehousing Concepts]. Regarding this, a DWH is exclusively updated in regular time intervals by the ETL process and not directly by end users. The Output Layer is represented typically by multiple data marts which are contain derived data subsets of the overall DWH "for a particular line of business" [ORA03, Data Warehousing Concepts]. A data mart feeds the front-end tools with data in the Presentation Layer. Within the Presentation Layer occurs the real business decision making with corresponding reporting and analysis tools or concepts. For the implementation of a BI solution, every layer needs metadata in the form of data warehouse objects and data models. Based on this, it is necessary to define appropriate data maps for the data workflow and processing in each BI solution layer.

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