

Design Patterns in Database Design:

Creational patterns:

Entities and relationships in ER (Entity-Relationship Model) as examples of Abstract Factory.
Relational table creation as an example of Builder.

Structural patterns:

Decoupling of logical database design from physical database design as an example of Bridge.
Aggregation/composition in EER as examples of Composite.
Views as an example of Façade and Observer.

Brief Description of Data Warehouses and Data Marts:

Databases are transactional in nature and they are used for day-to-day business operations. The operational data contain the detailed and up-to-date individual records of transactions. OLTP (On-Line Transaction Processing) is used to describe the type of processing in operational databases. These databases are usually use relational architecture and the data are highly normalized because of frequent updates (record additions and deletions).

For analysis purpose, the transactional data must be aggregated to provide meaningful summaries and usage patterns. Data warehouses use the consolidation of transaction data to provide historical and summary level information for decision support and data mining activities. The type of operation to analyze the data in data warehouses is called OLAP (On-Line Analytical Processing). Data mart is a subset of data warehouse or data that are tailored to a specific department within an organization.

The following table summaries the major differences between the operational databases in OLTP and the data warehouses/data marts in OLAP.

Databases in OLTP	Data Warehouse/Mart in OLAP
Transaction oriented	Subject oriented
Thousand of users	Few users
Small size (megabytes up to several gigabytes)	Huge size (gigabytes up to several terabytes)
Current, volatile data	Historical, non-volatile data
Data modeling: entity-relationship model	Data modeling: star/snowflake schema
Data structure: 2 dimension table	Data structure: multi-dimension cube
Normalized data	De-normalized data
Continuous update mode	Batch update mode
System is on-line 24 hours per day	Systems is static 24 hours per day
Query: simple to complex	Query: very complex

Design Patterns in Data Warehouses and Data Marts:

Creational patterns:

Entities and relationships in star/snowflake schema as examples of Abstract Factory.

Multi-dimensional cube as an example of Builder.

Structural patterns:

ROLAP (Relational OLAP), MOLAP (Multi-dimensional OLAP), and HOLAP (Hybrid OLAP) structure as examples of Bridge and Façade.

Detailed and summarized level data in a multi-dimensional cube to facilitate drill up/drill down as examples of Composite and Façade.

Behavioral patterns:

Drill through as an example of Chain of Responsibility.

Drill up/drill down operations as Iterator.

Data warehouses/marts as Observers of operational databases.

Data marts as Observer of data warehouse.

Data loading (batch updates) of data warehouse and data mart as examples of Mediator.