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Business Intelligence

An Overview of Business Intelligence Technology

Chaudhuri, S., Dayal, U. and Narasayya, V., 2011.
An overview of business intelligence
technology. *Communications of the ACM*, 54(8),
pp.88-98.

Objectives

- Discuss the meaning of Business Intelligence
- State the purpose of Business Intelligence Systems
- Construct structure of Intelligence Systems
- Discuss Areas where BI Technology is applied
- Identify Typical business intelligence architecture
- Understand the layers of the Framework for Business Intelligence Architecture
- Discuss the BI project life cycle

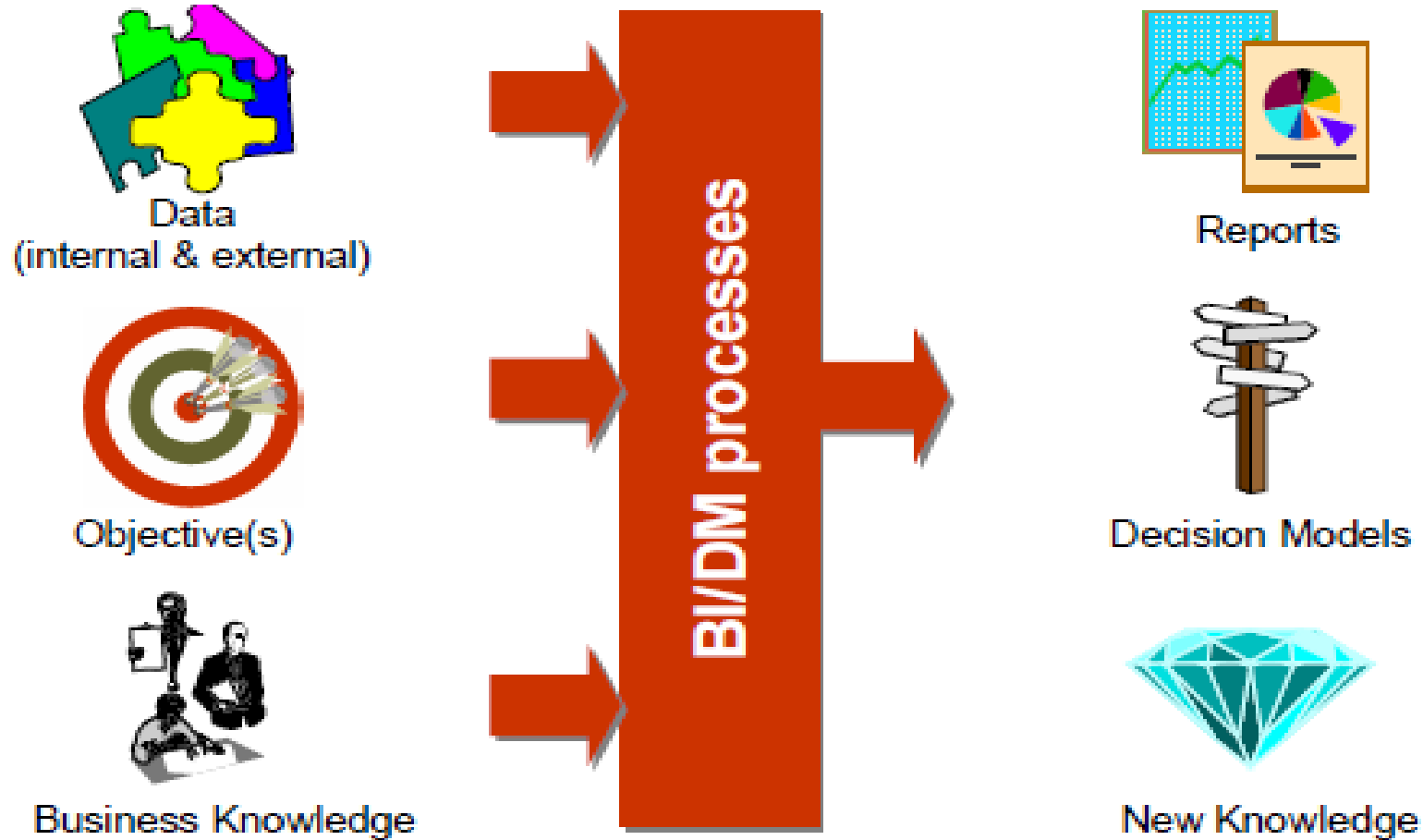
Introduction

.Business intelligence (BI) is “about how to capture, access, understand, analyze and turn one of the most valuable assets of an enterprise - **raw data** - into actionable information in order to improve business performance” .

.It combines data gathering, data storage, and knowledge management with analytic tools to provide decision-makers with competitive information that often act as differentiators in today's fierce business environment .

BUSINESS INTELLIGENCE

Input-Output View



Data ,Information and Knowledge

■ Data

- Data are any facts, numbers, or text that can be processed by a computer.
 - operational or transactional data (sales, cost, inventory, payroll accounting),
 - non-operational data (industry sales, forecast data etc.)
 - metadata → data about data.

■ Information

- Patterns
- Associations → relationships among all types of data.
 - Eg Analysis of retail point of sale transaction data can yield information on which products are selling and when.

■ Knowledge

- Information can be converted into knowledge.
- **Example:** Summary information on supermarket sales can be analysed in view of promotional efforts to provide knowledge of consumer buying behaviour.

Business intelligence (BI) software is a collection of decision support technologies for the enterprise aimed at enabling knowledge workers such as executives, managers, and analysts to make better and faster decisions.

Sources:

- customer transactions in banking, retail as well as in e-businesses,
- RFID tags for inventory tracking,
- email,
- query logs for Web sites,
- blogs,
- product reviews.

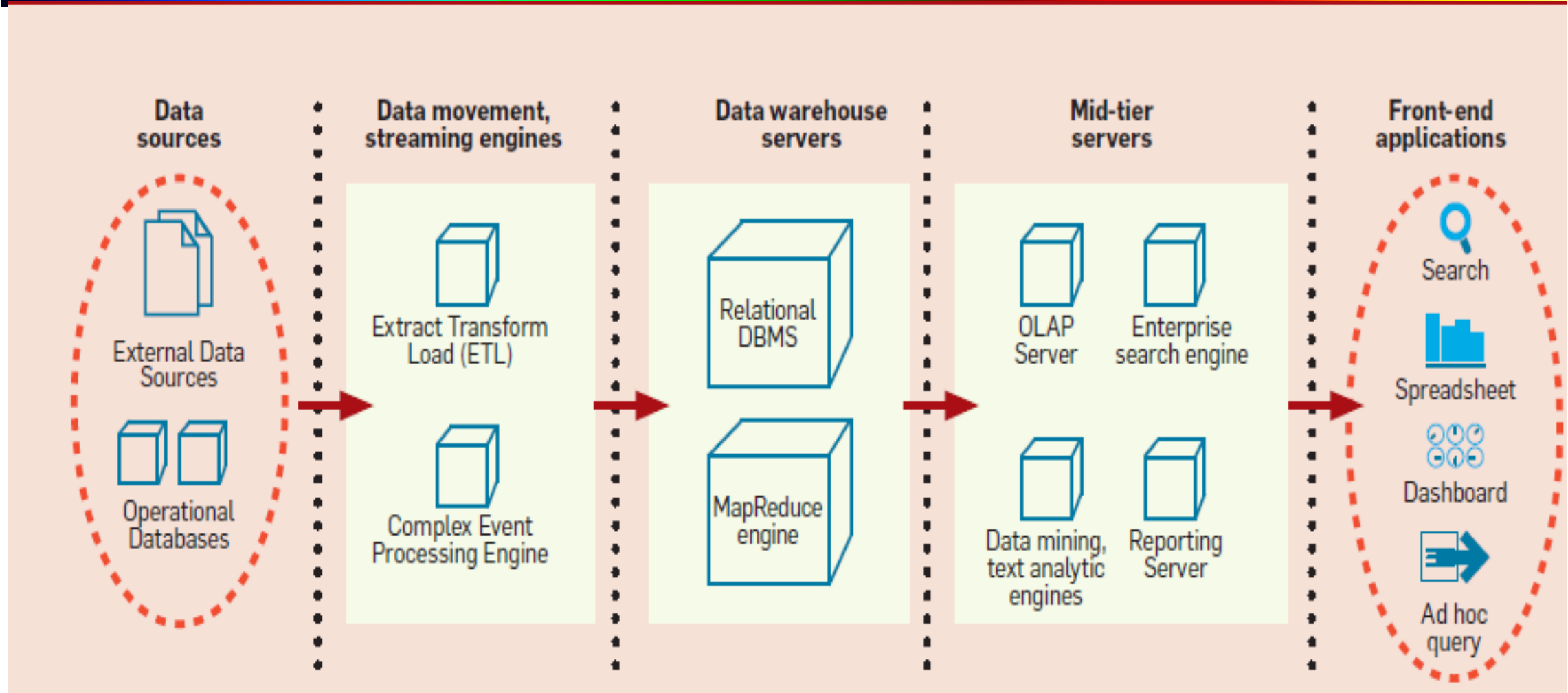
BI Areas of Application

- Manufacturing for order shipment and customer support,
- Retail for user profiling to target grocery coupons during checkout
- Financial services for claims analysis and fraud detection
- Transportation for fleet management,
- Telecommunications for identifying reasons for customer churn
- Utilities for power usage analysis
- Health care for outcomes analysis.

Business Intelligence Architecture

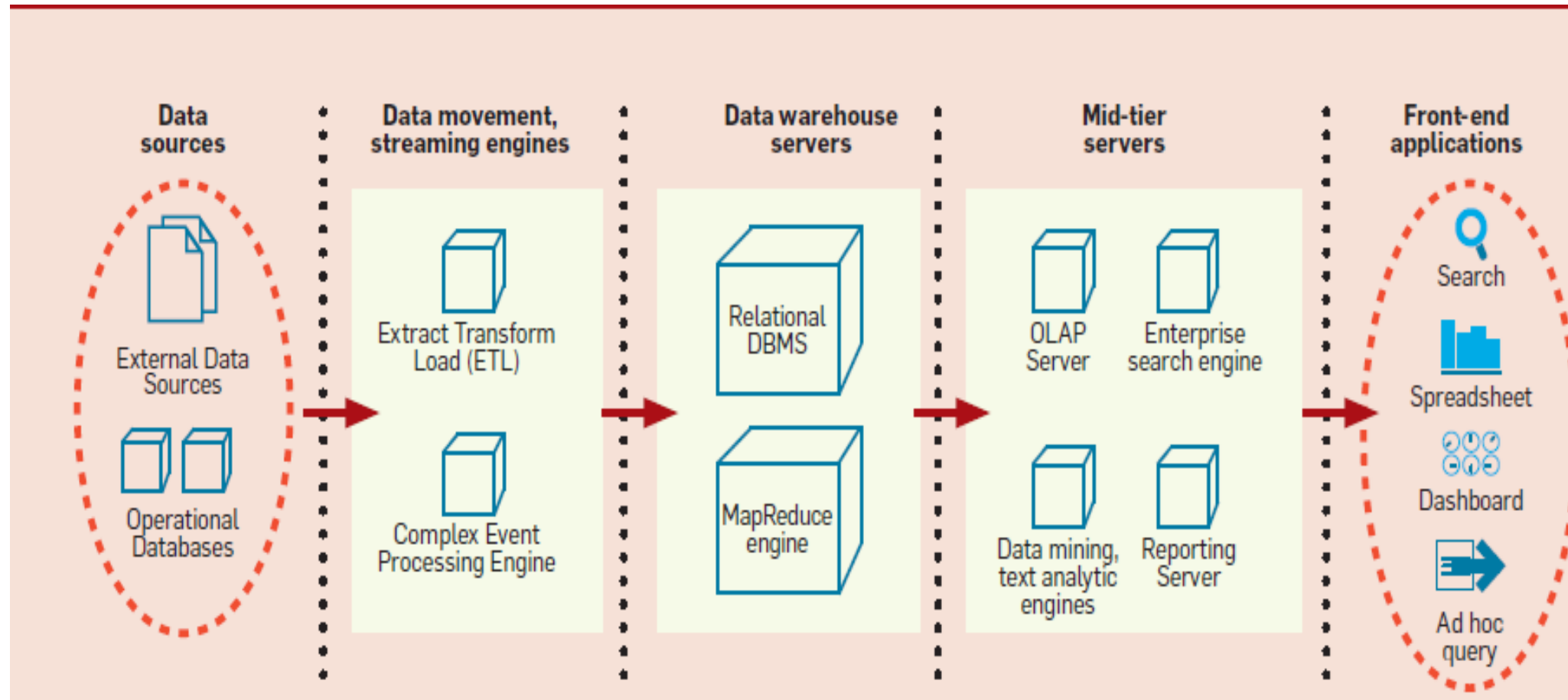
- **BI architecture** is a framework detailing different components of BI (i.e., data, people, processes, technology, and the management) and how these components need to come together to ensure smooth functioning of a BI system.
- Key Insights
 - The cost of data acquisition and data storage has declined significantly.
 - New massively parallel data architectures and analytic tools go beyond traditional parallel SQL data warehouses and OLAP engines.
 - The need to shorten the time lag between data acquisition and decision making is spurring innovations in BI technologies.

Typical business intelligence architecture.



Typical business intelligence architecture

- Data often comes from different sources
- Data is of varying quality, inconsistent representations, codes, and formats and needs to be reconciled

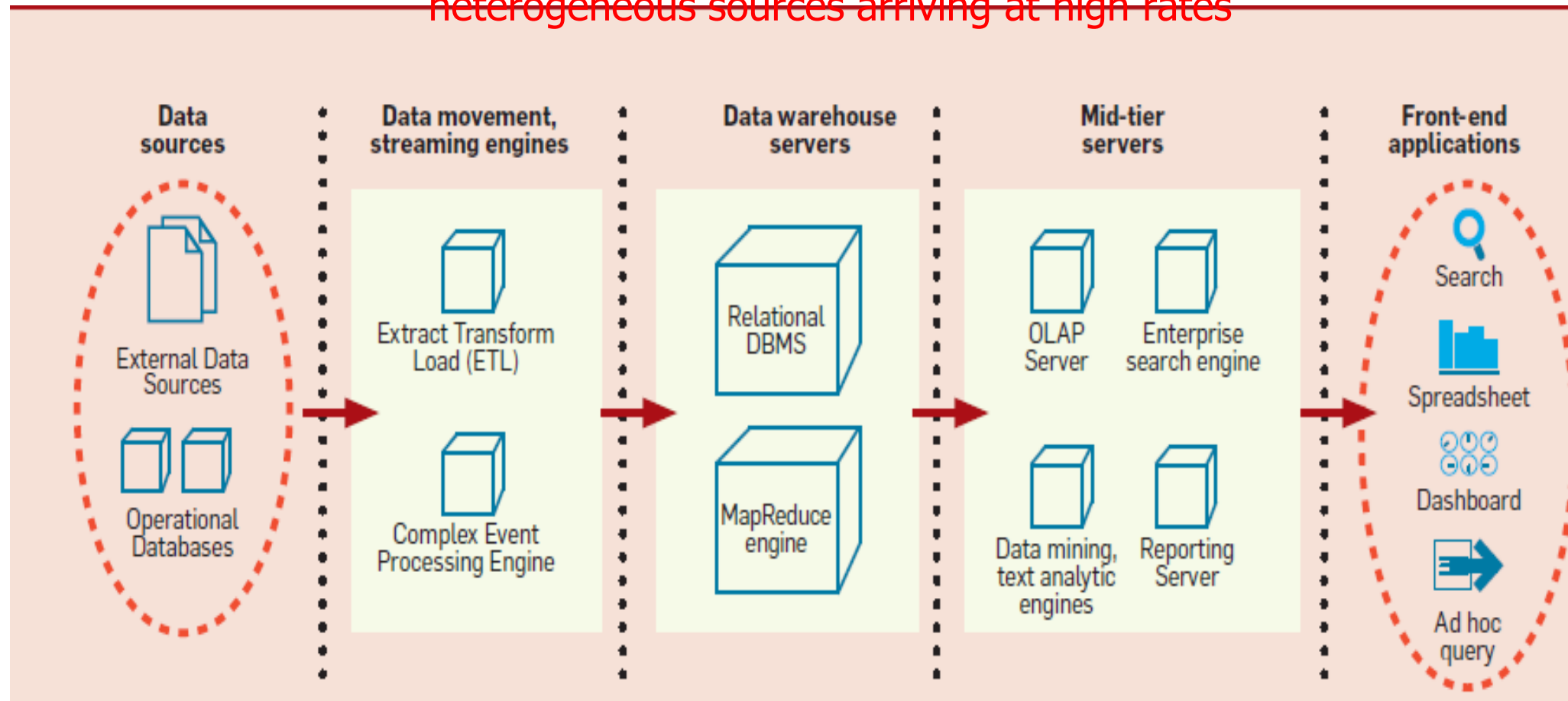


Data Sources

- The data over which BI tasks are performed often comes from different sources — typically from multiple operational databases across departments within the organization, as well as external vendors.
- Different sources contain data of varying quality, use inconsistent representations, codes, and formats, which have to be reconciled.
- Thus, the problems of integrating, cleansing, and standardizing data in preparation for BI tasks can be rather challenging.

Typical business intelligence architecture.

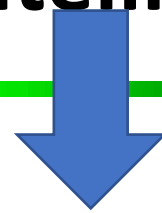
Data undergoes integration, cleansing, and standardizing to prepare it for BI tasks using Back-end technologies and Complex Event Processing (CEP) support processing in real time, data streams from heterogeneous sources arriving at high rates



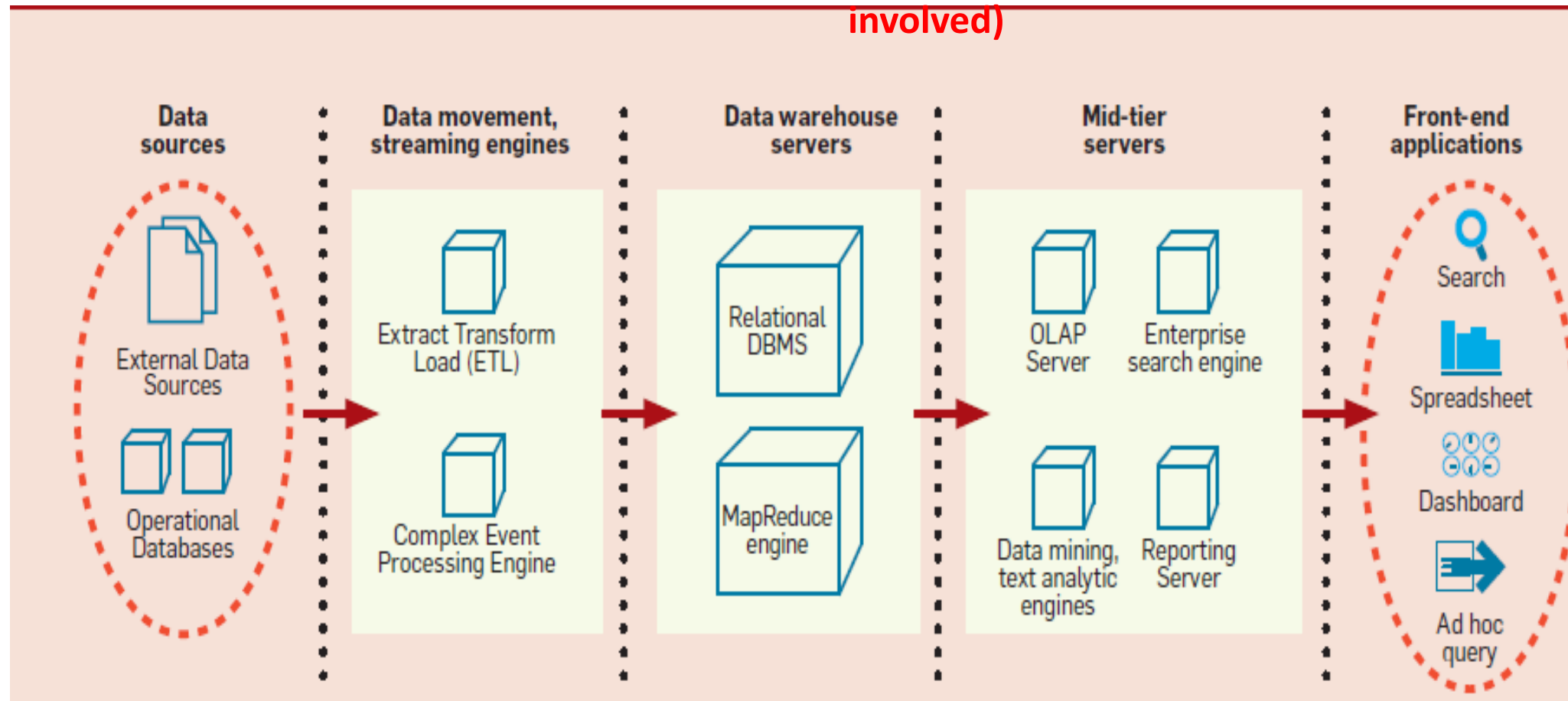
Data movement, streaming engines

- BI tasks usually need to be performed incrementally as new data arrives
- The back-end technologies for preparing the data for BI are collectively referred to as *Extract-Transform-Load (ETL)* tools
- Specialized engines referred to as *Complex Event Processing (CEP) engines* have emerged to support BI tasks in near real time

Typical business intelligence architecture



Data over which BI tasks are performed is loaded *into the (RDBMS) data warehouse and engines based on the MapReduce paradigm (if larger data volume are involved)*

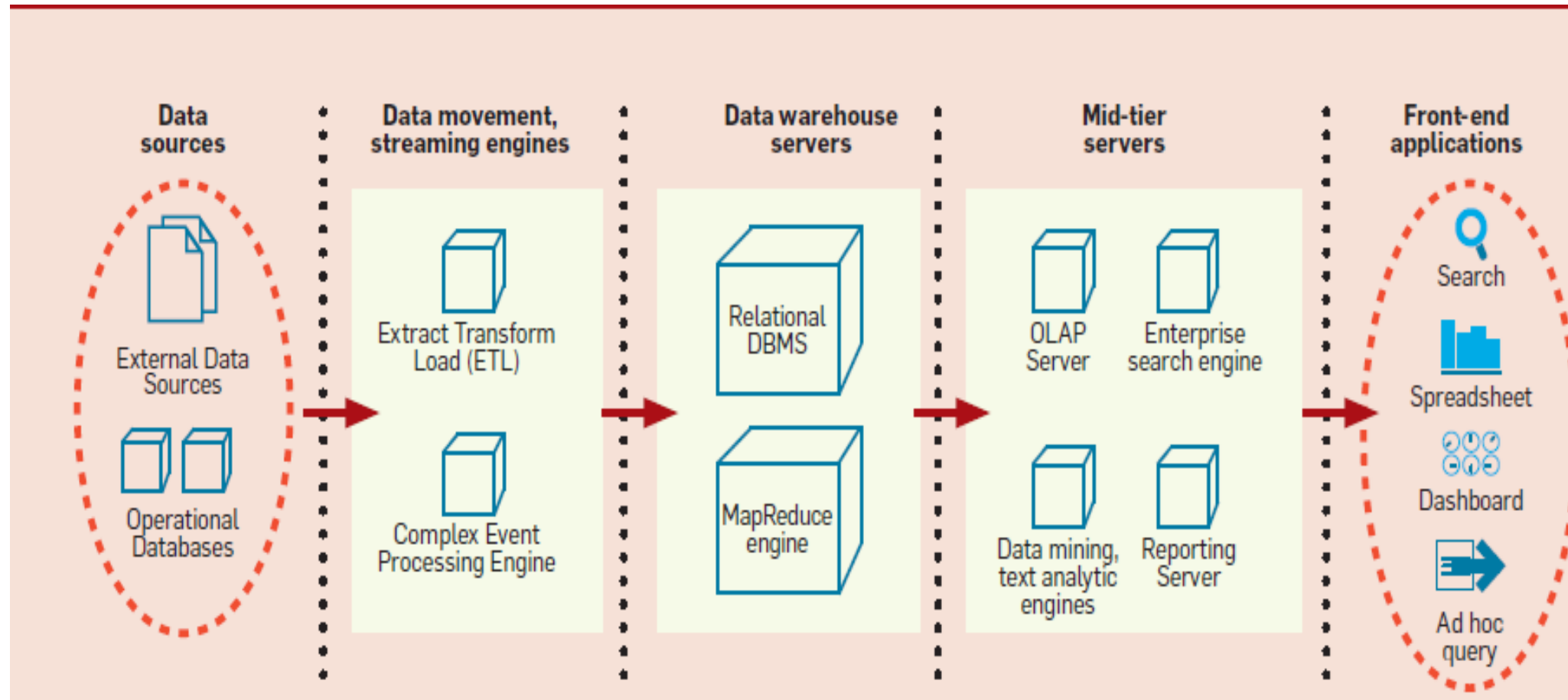


Data Warehouse Servers

- The data over which BI tasks are performed is typically loaded into a repository called the *data warehouse* that is managed by one or more data warehouse servers.
- A popular choice of engines for storing and querying warehouse data is relational database management systems (RDBMS).
- There is increasing desire to architect low-cost data platforms that can support much larger data volumes
- Engines based on the *MapReduce* paradigm support this “Big Data” challenge

Typical business intelligence architecture

Engines used to support the Data warehouse

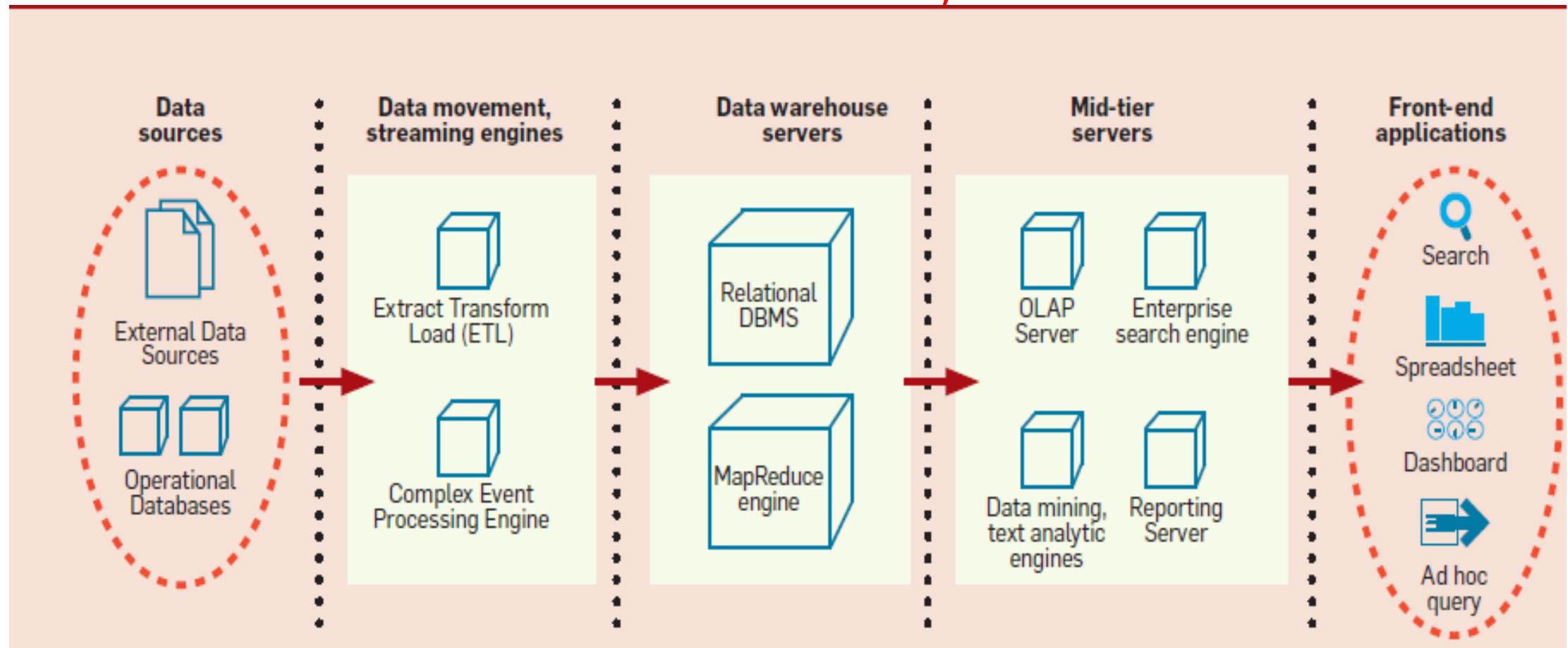
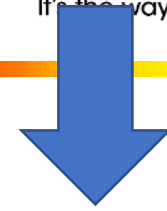


Mid-Tier Servers

- *Mid-tier servers* provide specialized functionality for different BI scenarios.
- *Online analytic processing (OLAP)* servers efficiently expose the multidimensional view of data to applications or users and enable the common BI operations such as filtering, aggregation, drill-down and pivoting.
- *Reporting servers* enable definition, efficient execution and rendering of reports
- *Enterprise search engines* support the keyword search paradigm over text and structured data in the warehouse
- *Data mining engines* enable in-depth analysis of data beyond what is offered by OLAP or reporting servers.
- *Text analytic engines* can analyze large amounts of text data (for example, survey responses or customer reviews) and extract valuable information that would otherwise require significant manual effort

Typical business intelligence architecture

Management applications that enable decision makers to track key performance indicators of the business,



Front-End Applications

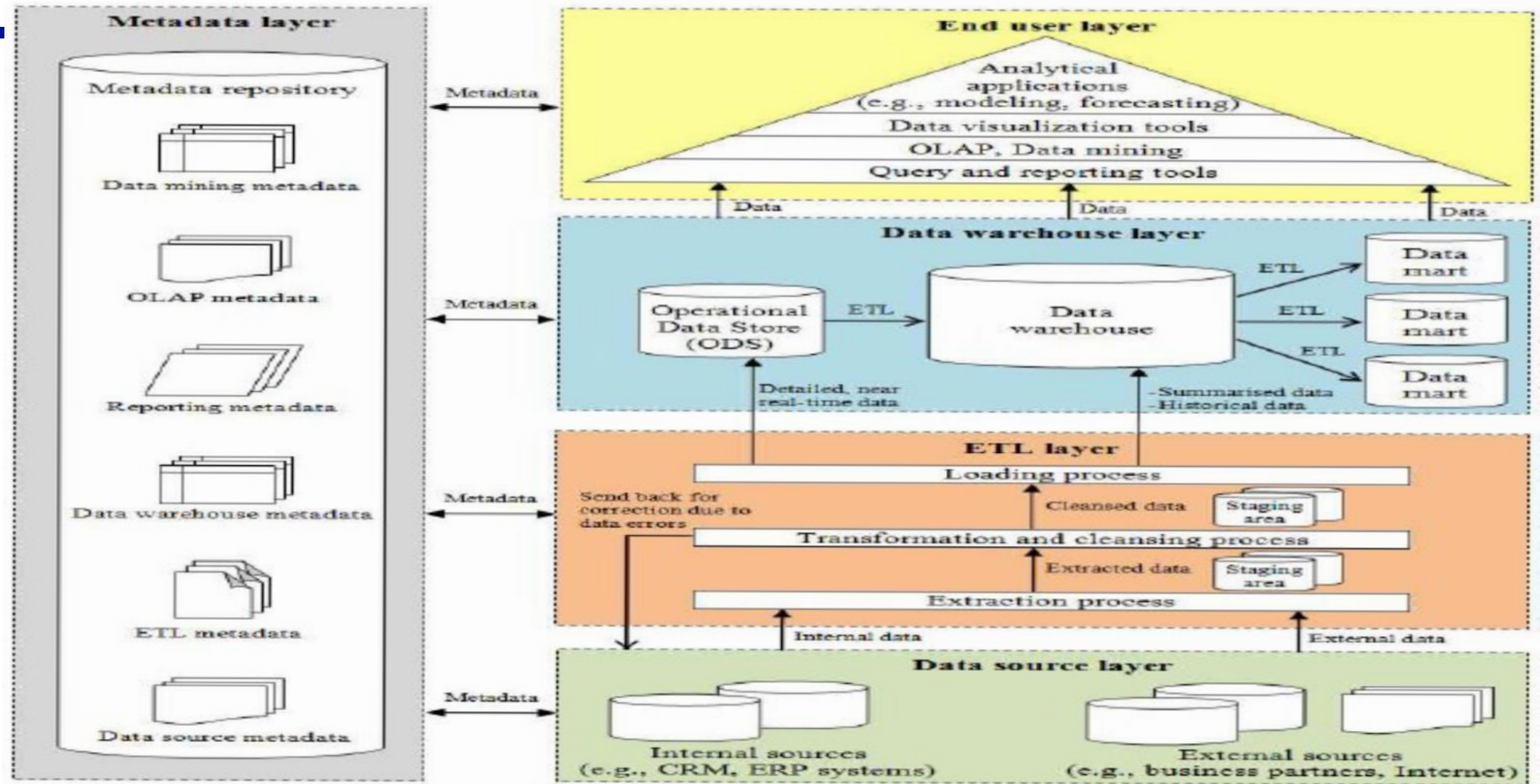
- There are several popular front-end applications through which users perform BI tasks:
 - spreadsheets, enterprise portals for searching, performance management applications that enable decision makers to track key performance indicators of the business using visual dashboards, tools that allow users to pose ad hoc queries, viewers for data mining models, etc.
- Rapid, ad hoc *visualization* of data can enable dynamic exploration of patterns, outliers and help uncover relevant facts for BI.
- In addition, there are other BI technologies such as Web analytics mobile BI apps.

Business Intelligence Architecture

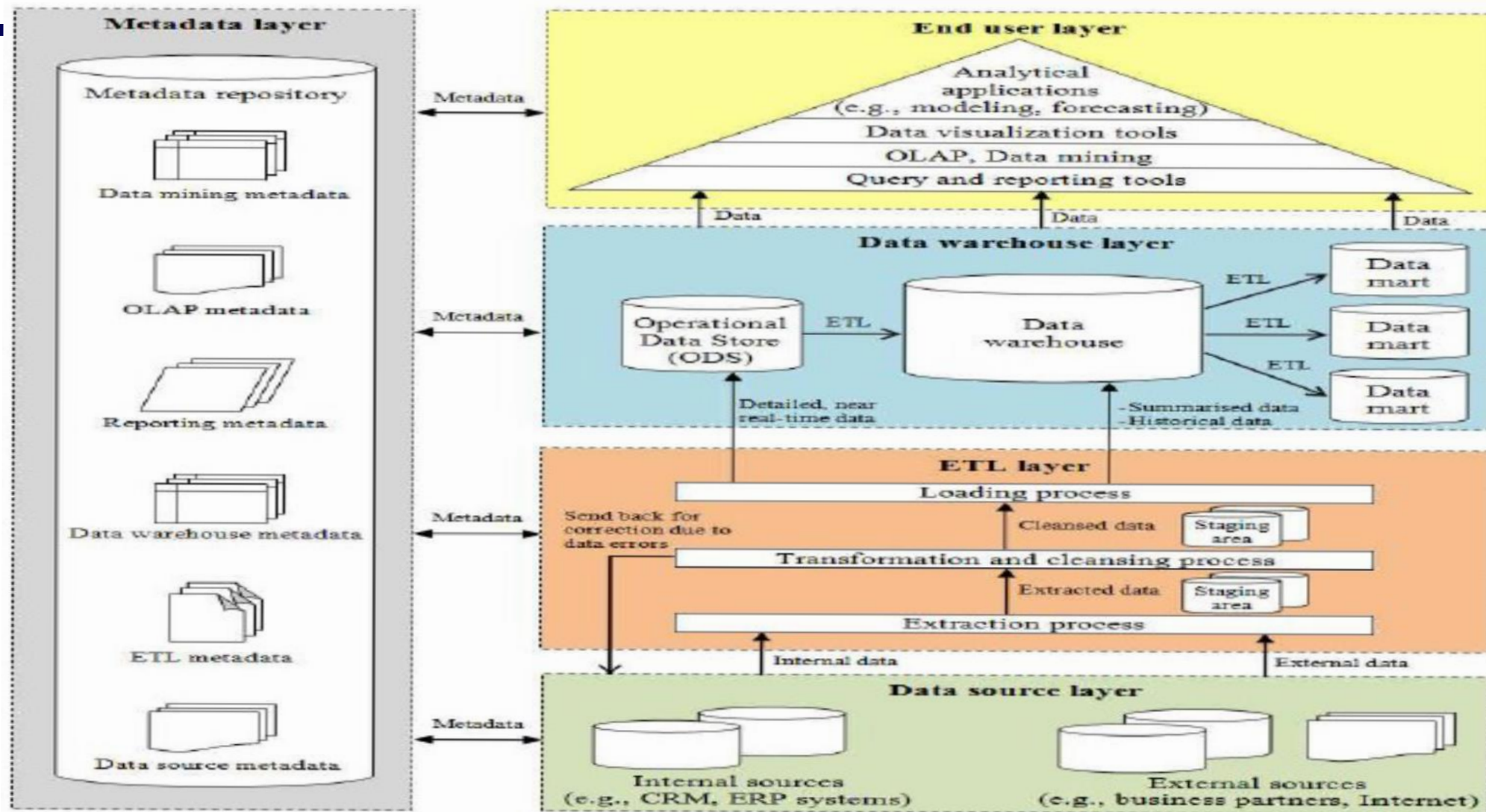
- Ong *et al.*, (2011) propose a framework of a five-layered BI architecture that takes into consideration the value and quality of data as well as information flow in the system.
- The five layers are:
 - Data Source,
 - Extract-Transform-Load (ETL),
 - Data Warehouse,
 - End User,
 - Metadata Layers

Framework of Business Intelligence Architecture

It's the way we're wired

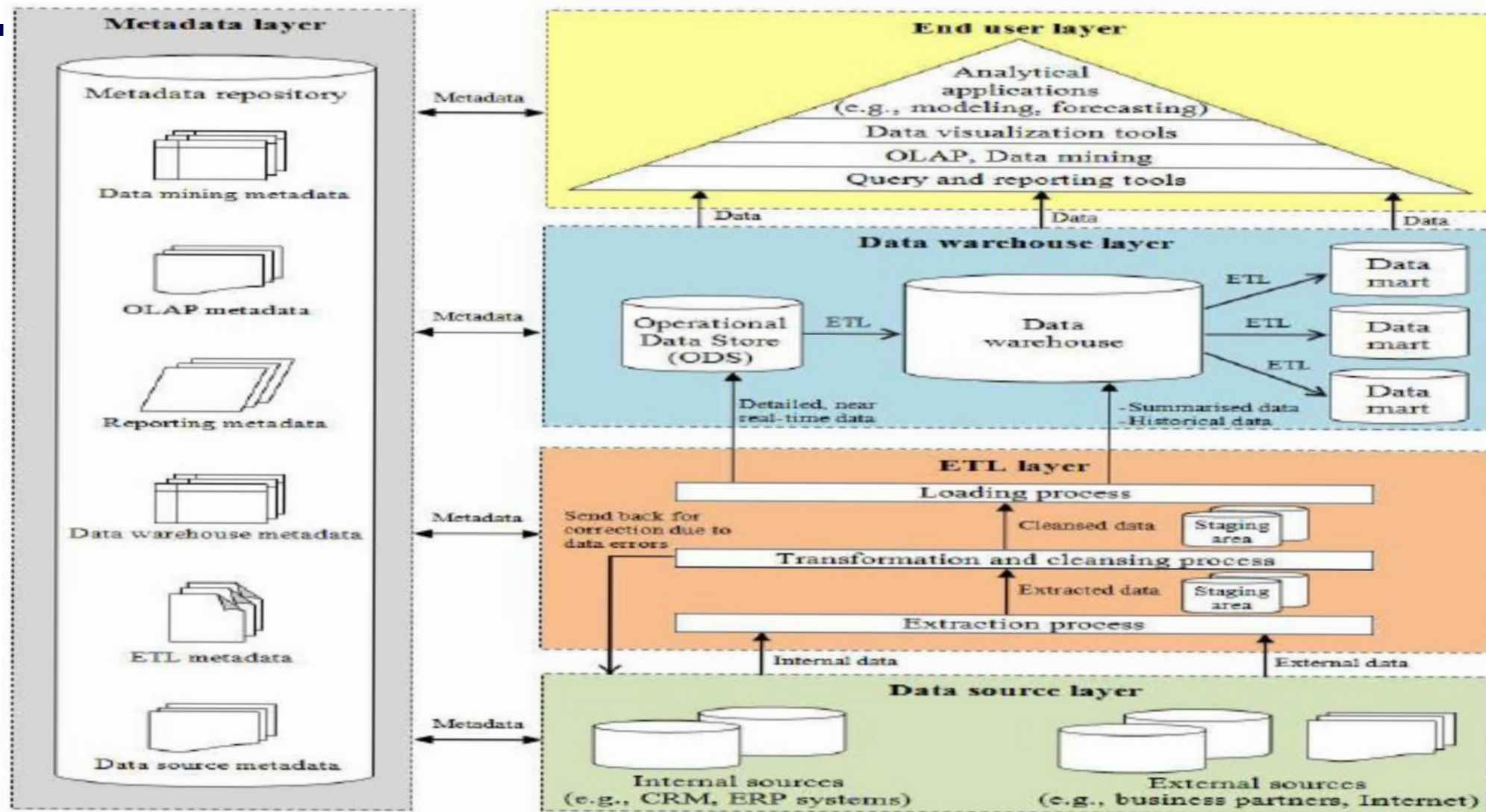


Framework of Business Intelligence Architecture



Data often related to competitors, market, environment and technology

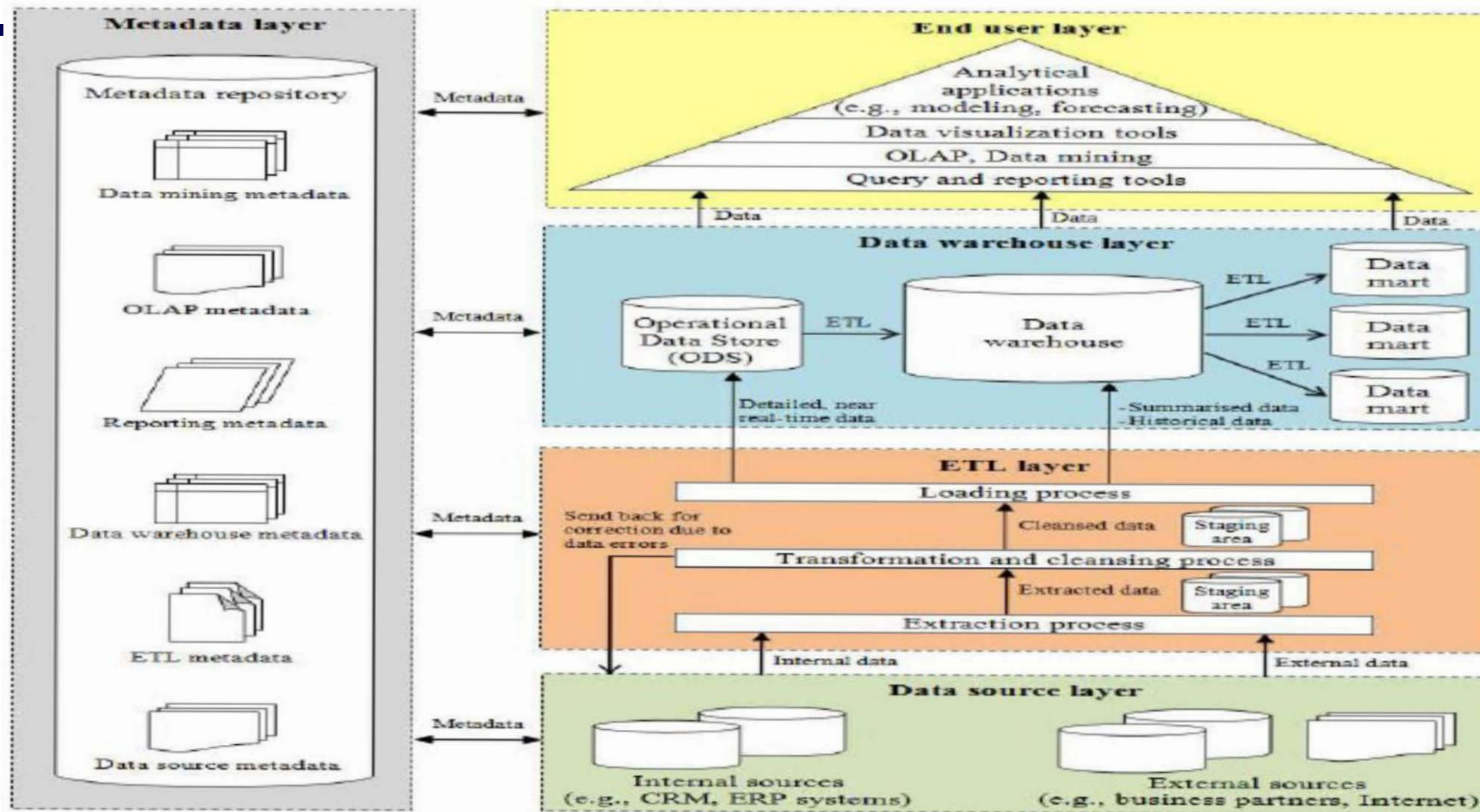
Framework of Business Intelligence Architecture



Identify, collect and convert data using a set of business rules before loading into the target repository

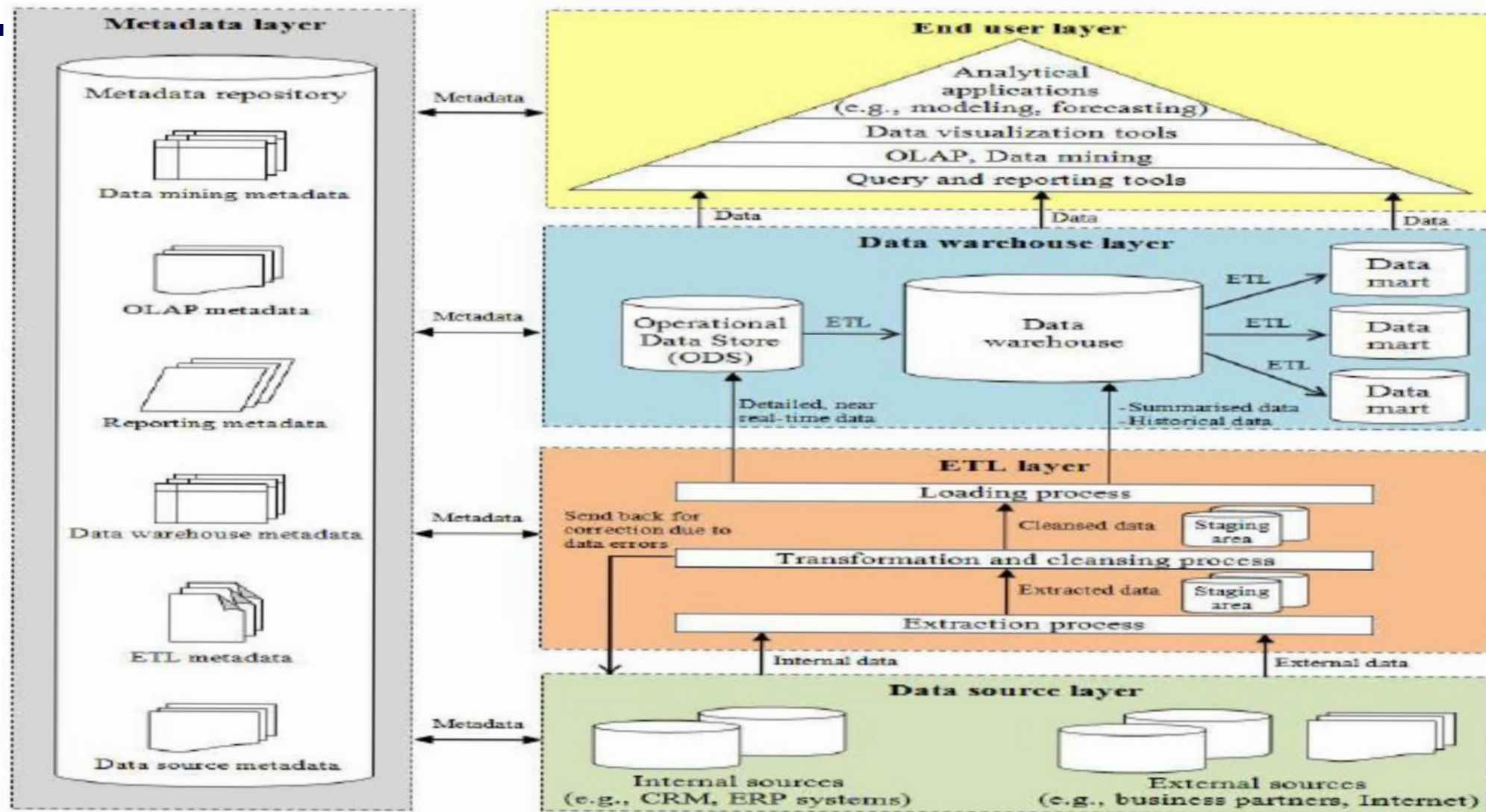


Framework of Business Intelligence Architecture



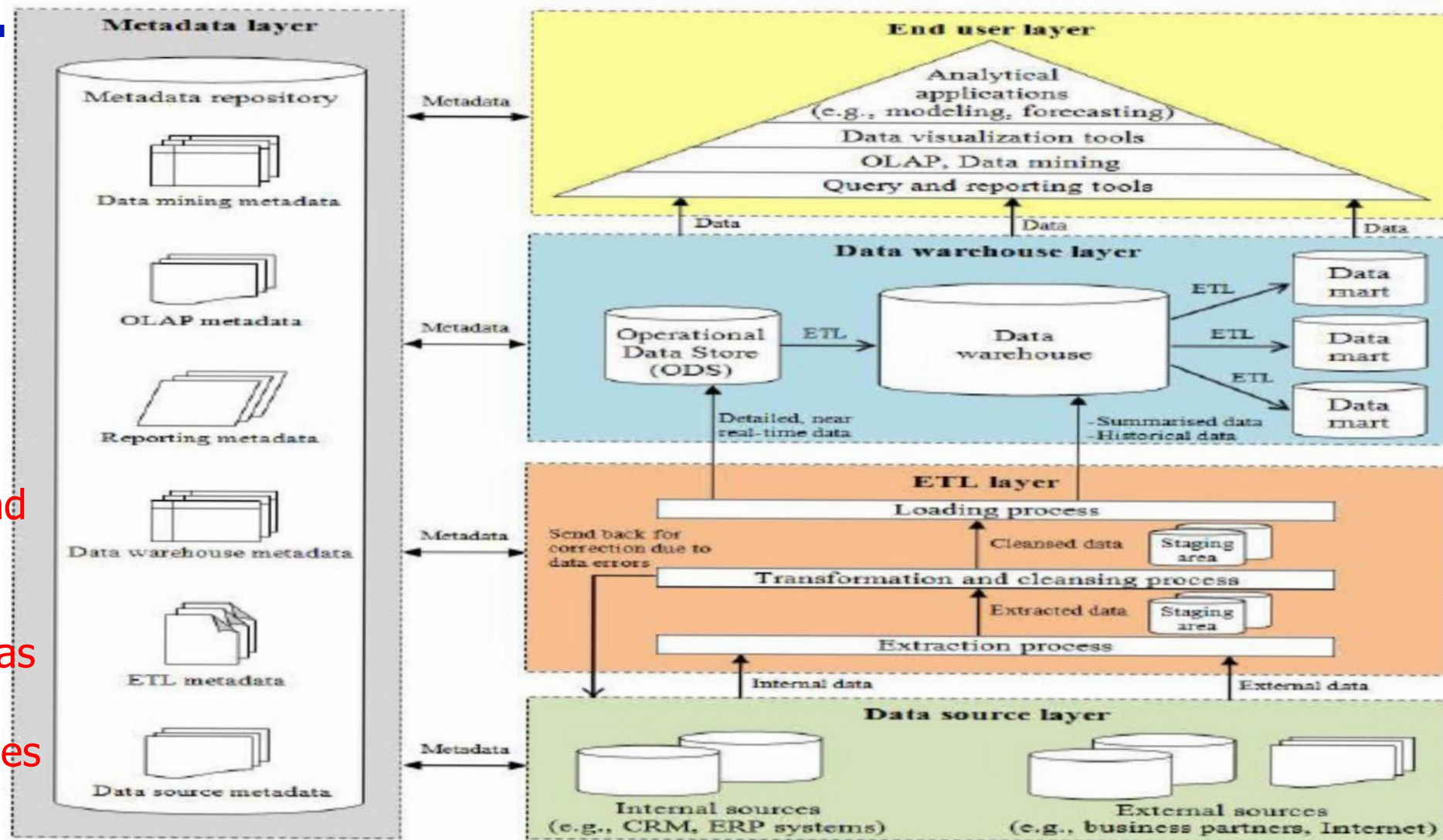
← Data flows from operational data store to data warehouse and subsequently to data mart

Framework of Business Intelligence Architecture



Tools that display information in different formats to different users.

Framework of Business Intelligence Architecture



Stores technical and business information about data as well as business rules and data definitions.

BI project life cycle

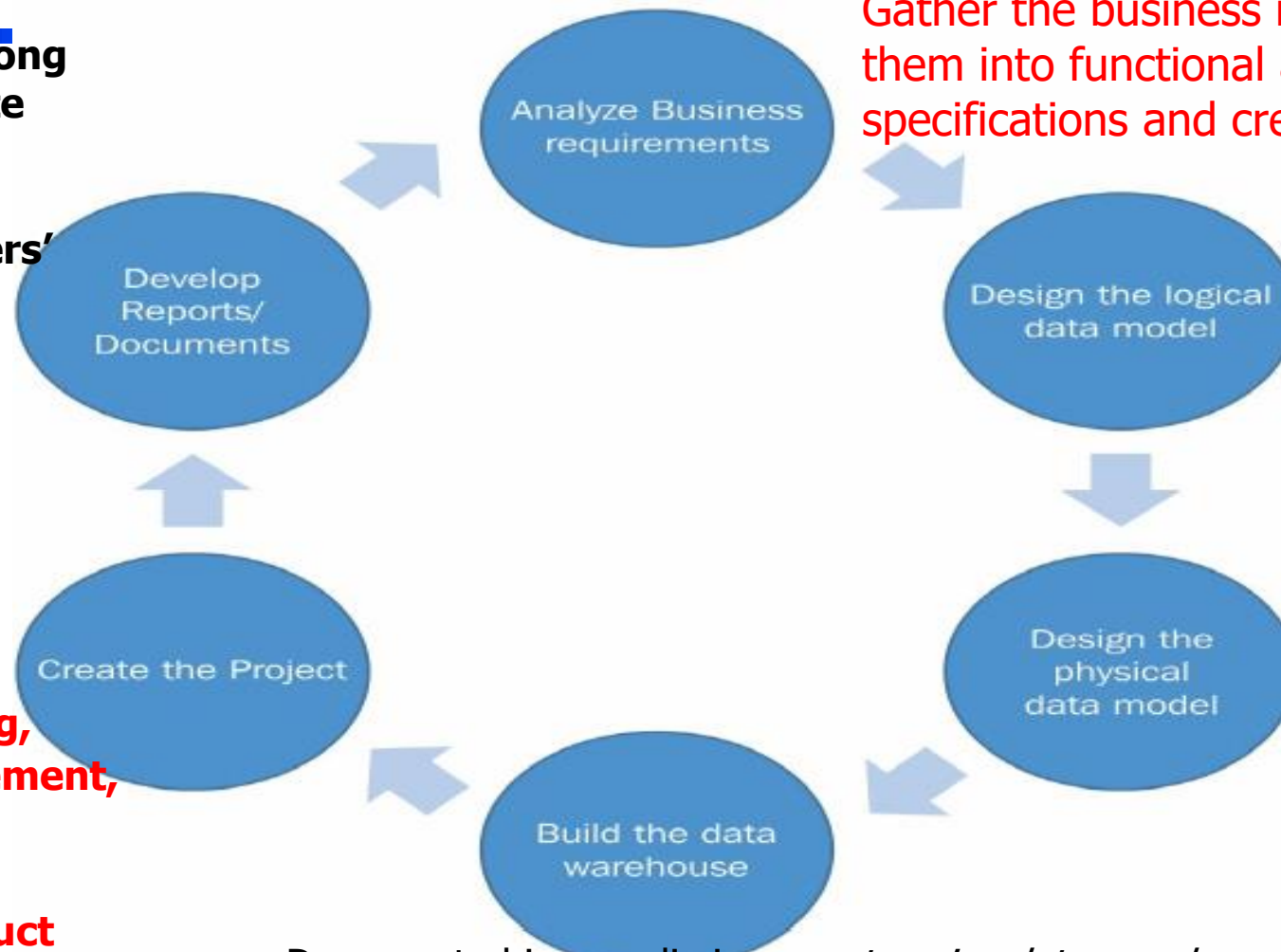
.Every BI project has its own life cycle according to

- application domain,
- personal attitude of the decision makers
- Available analytical methodologies.

Typical life cycle

Identify the candidate BI applications, along with appropriate navigation interfaces to address the users' needs and capabilities.

Project Planning, Project Management, Business Requirement Definition, Product selection and installation



Gather the business requirements and transform them into functional and non-functional specifications and create a template for reports

Build a logical Model based on business requirements, which shows the business entities and the relationships between them.

Transform the logical data model into a physical data model which defines the structure

Documented in a preliminary *enterprise data warehouse* representing the organization's key business processes and their associated dimensionality. (**Dimensional Modelling**)

Typical BI Project Life Cycle

- **Step 1: Analyze Business requirements** - gather the business requirements and transform them into functional and non-functional specifications, create a template for reports, and so on.
- **Step 2: Design the logical data model** - build a logical data model based on business requirements, which shows the business entities and the relationships between them.
- **Step 3: Design the physical data model** - transform the logical data model into a physical data model which defines the structure of the data warehouse.
- **Step 4: Build the data warehouse** - create the data warehouse, build data marts, and load data.
- **Step 5: Create the Project** - start to work directly in chosen BI software and define schema, attributes, facts, hierarchies and so on.
- **Step 6: Develop Reports/Documents.**

Review Questions

1. What is Business Intelligence (BI)?
2. Give some examples of its applications.
3. Explain the concept of the data warehouse.
4. What is Extract, Transform, and Load??
5. What is the purpose of business intelligence systems?
6. What are the key advantages of business intelligence system?
7. Write a brief description of Business Intelligence Applications.