Advanced Data Management Technologies

Unit 3 — Building a Data Warehouse

J. Gamper

Free University of Bozen-Bolzano
Faculty of Computer Science
IDSE

Acknowledgements: I am indebted to Michael Böhlen and Stefano Rizzi for providing me their slides, upon which these lecture notes are based.

Outline

1. Methodological Framework to Build a DW
2. DW Project Management

Outline

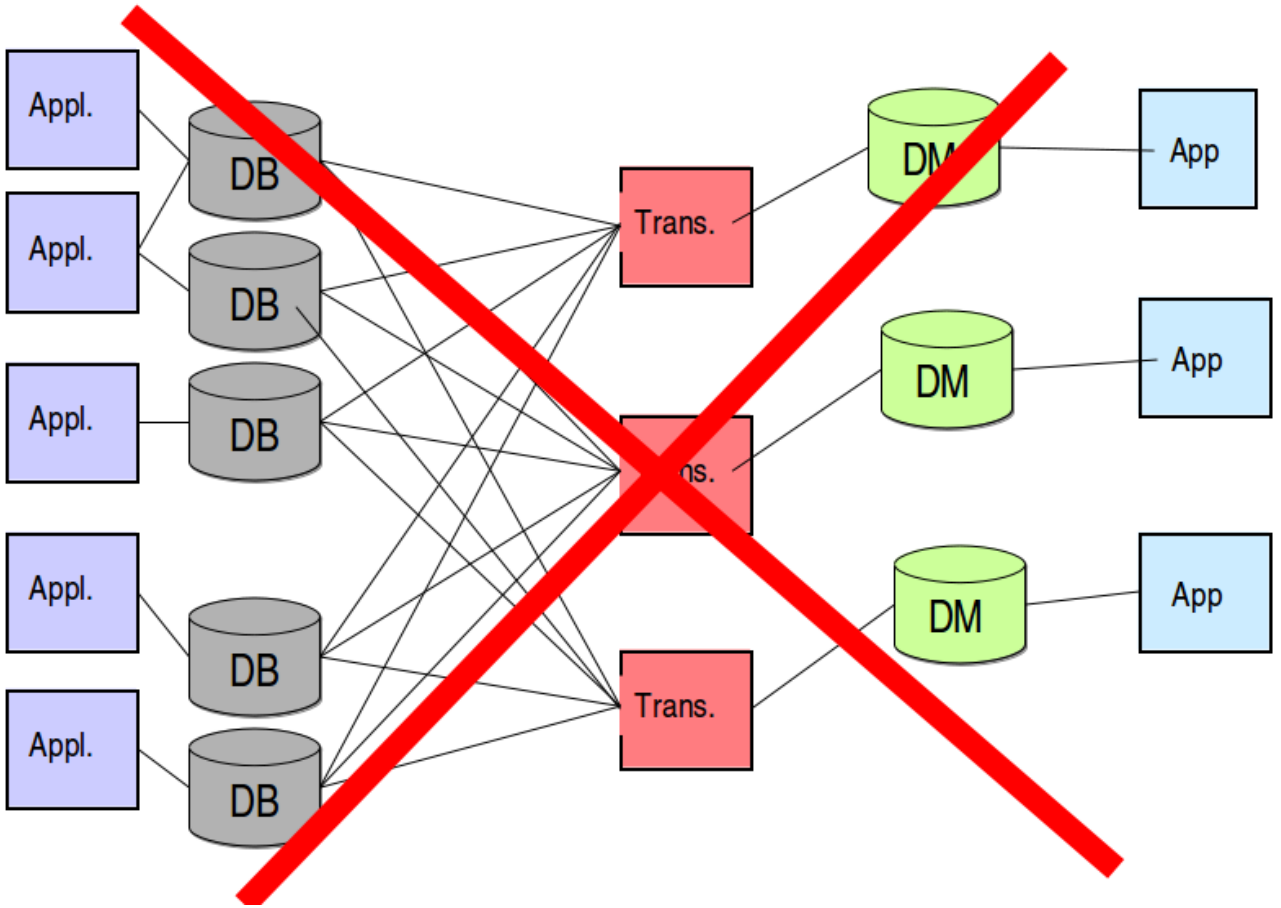
1 Methodological Framework to Build a DW

2 DW Project Management

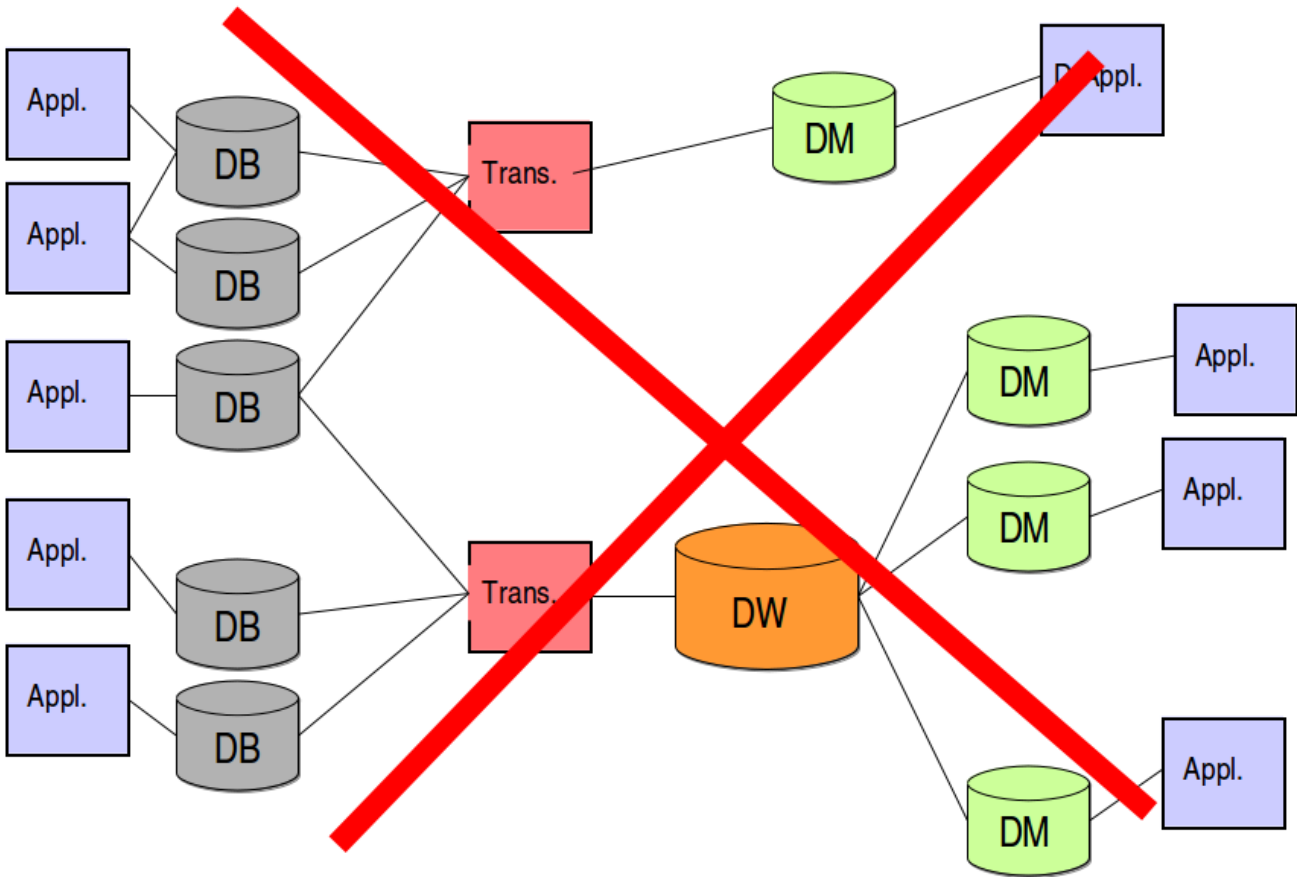
Methodological Framework

- Building a DW is a very complex task
- It requires an accurate planning aimed at devising satisfactory answers to organizational and architectural questions
- A large number of organizations lack experience and skills that are required to meet the challenges involved in DW projects
- Reports of DW project failures state that a major cause lies in the absence of a global view of the design process,
  - i.e., absence of a design methodology

Many Ways not to Do/1



Many Ways not to Do/2



Top-Down Approach

- **Top-down approach:** Analyze global business needs, plan how to develop a data warehouse, design it, and implement it as a whole

- Looks promising as it is based on a global picture of the goal to achieve, and in principle it ensures consistent, well integrated DW
- High cost estimates with long-term implementations discourage company managers
- Analyzing/integrating all relevant sources at the same time is a very difficult task, even because it is not very likely that they are all available and stable at the same time.
- It is extremely difficult to forecast the specific needs of every department, which can result in the analysis process coming to a standstill.
- Since no working system is delivered in the short term, users cannot check for this project to be useful, so they lose trust and interest in it.

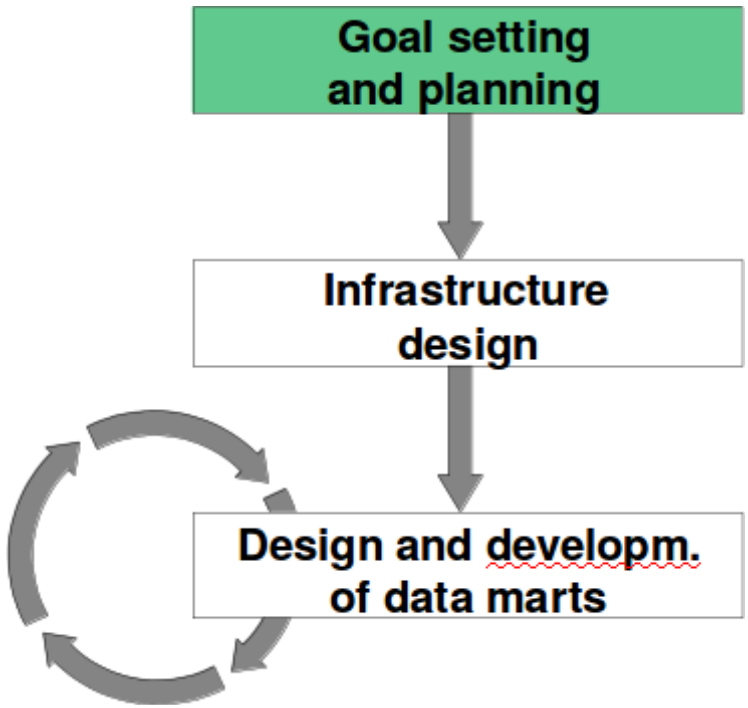
Bottom-Up Approach

- **Bottom-up approach:** DW is incrementally built by iteratively creating several data marts
  - Each data mart is based on a set of facts that are linked to a specific department and that can be interesting for a user group

- Leads to concrete results in a short time
- Does not require huge investments
- Enables designers to investigate one area at a time
- Gives managers a quick feedback about the actual benefits of the system being built
- Keeps the interest for the project constantly high
- May determine a partial vision of the business domain

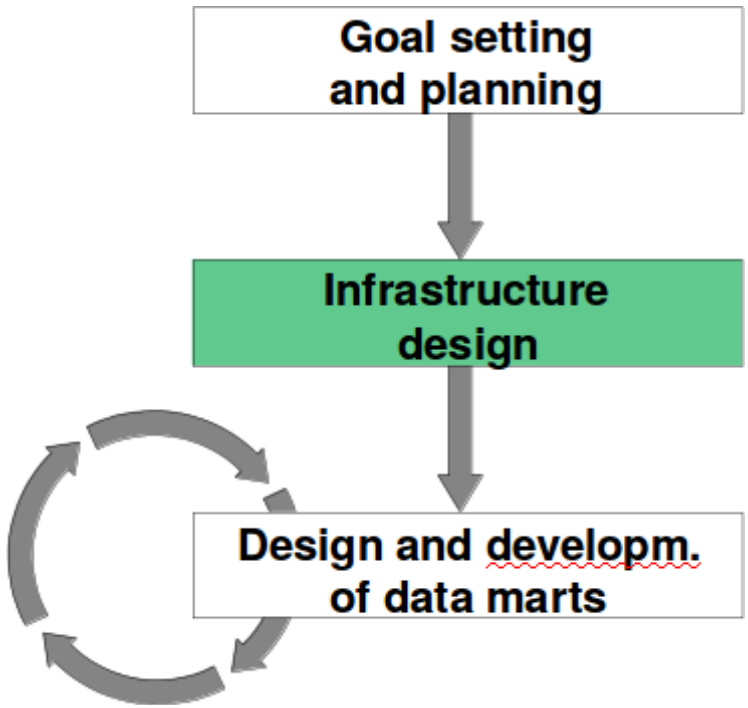
The Life-cycle – Goal Setting and Planning

- Set system goals, borders, and size
- Select an approach for design and implementation
- Estimate costs and benefits
- Analyze risks and expectations
- Examine the skills of the working team



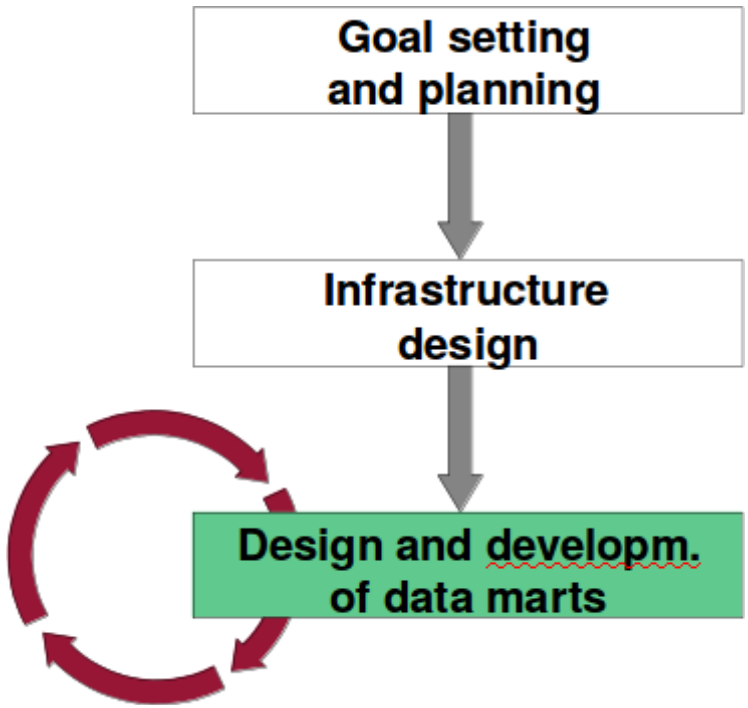
The Life-cycle – Infrastructure Design

- Analyze and compare the possible architectural solutions
- Assess the available technologies and tools
- Create a preliminary plan of the whole system

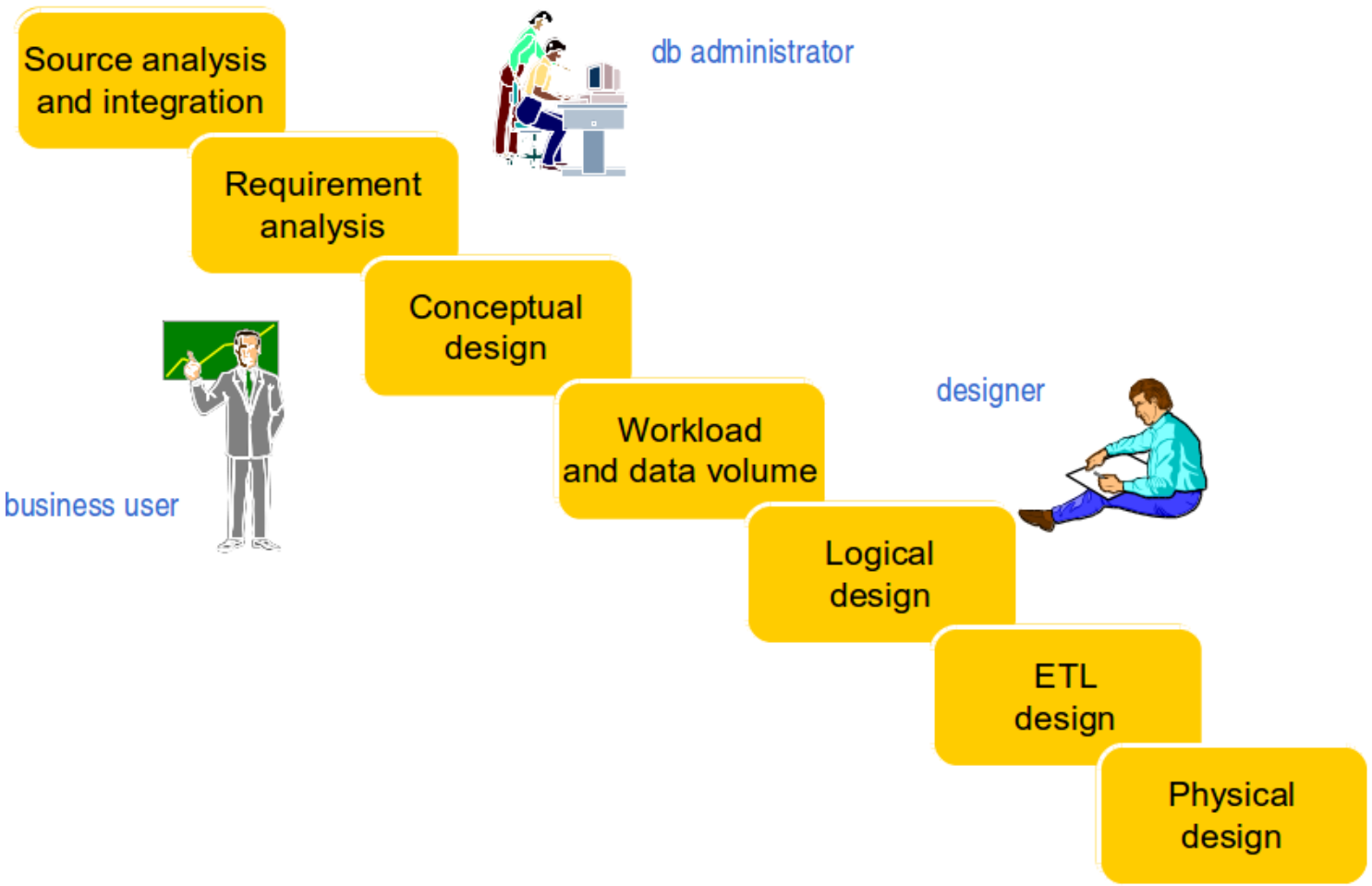


The Life-cycle – Design and Development of DMs

- Every iteration causes a new DM and new applications to be created and progressively added to the DW system.



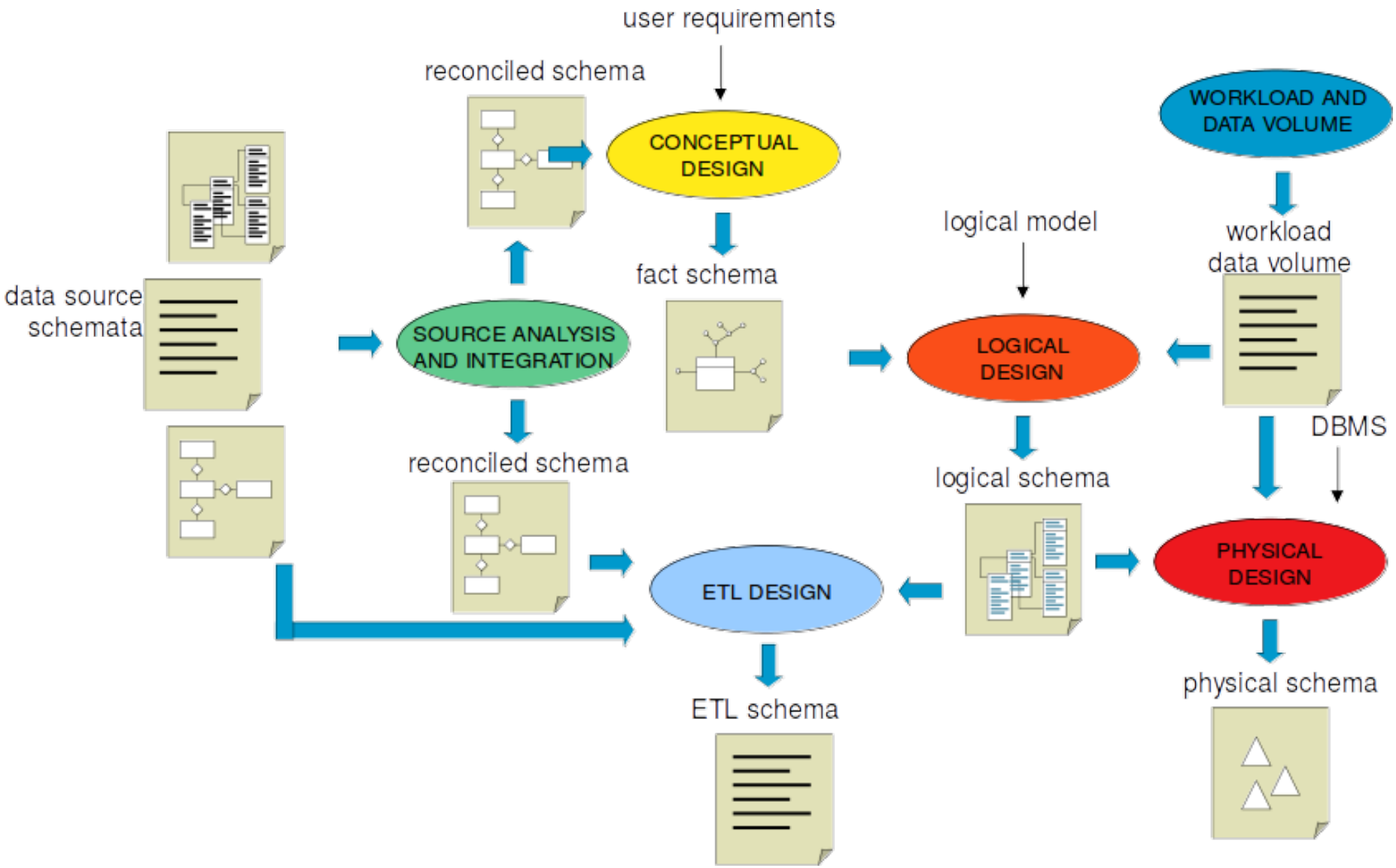
Data Mart Design Phases



Different Approaches for DM Design

- Supply-driven (data-driven) approach
- Demand-driven (requirement-driven) approach
- Mixed approach

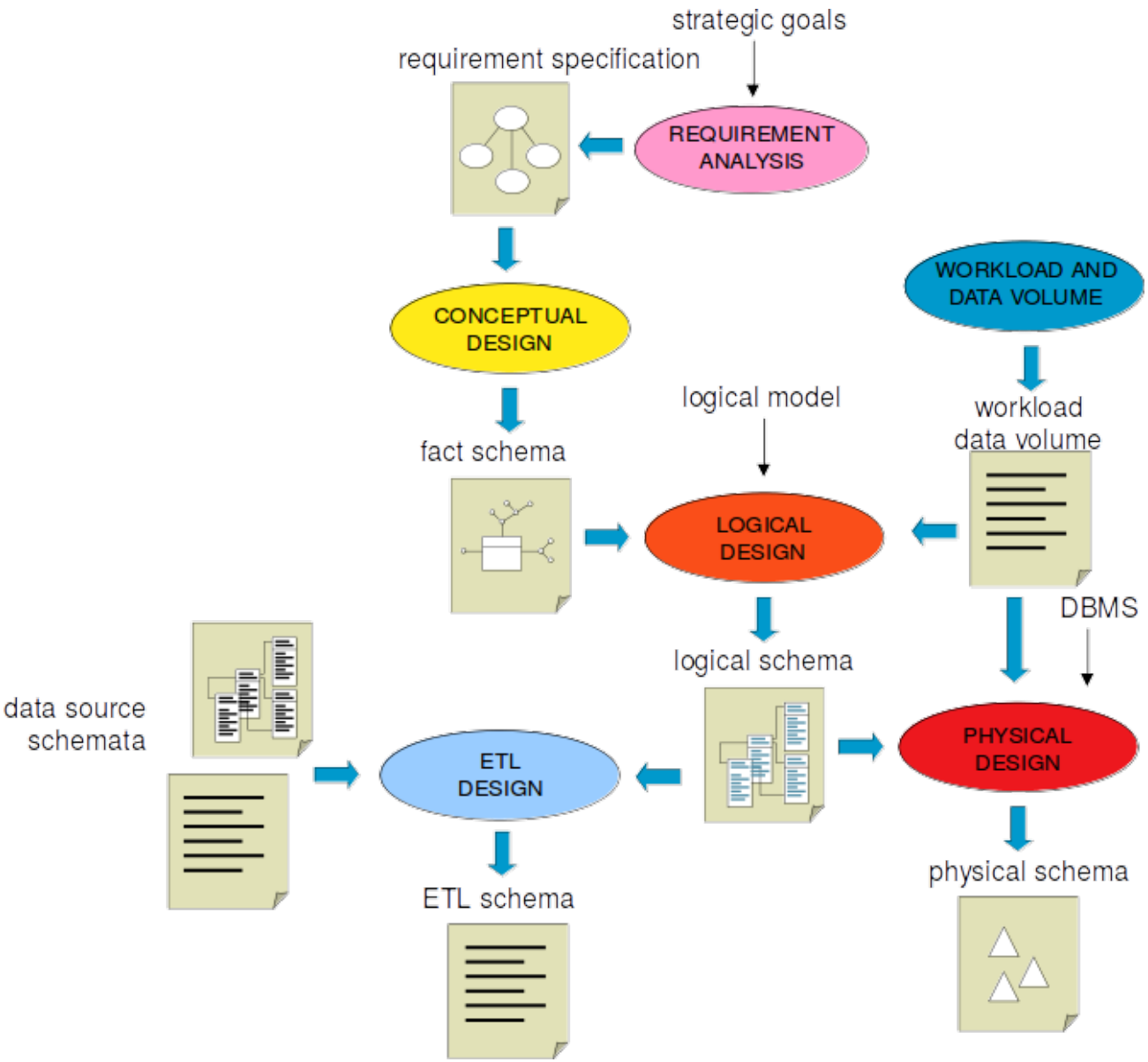
Supply-driven (Data-driven) DM Design/1



Supply-driven (Data-driven) DM Design/2

- Approach
  - Begin with an analysis of the data sources
  - User requirements show designers which groups of data should be selected
- Pros
  - Initial conceptual schema for DMs can be automatically derived from the reconciled layer
  - ETL design is extremely streamlined because every single information piece in a DM is directly associated with source attributes
  - Resulting DMs are stable in time since they are rooted in source schemata
  - In general, project goals can be reached in a short time
- Cons
  - User requirements play a minor role when specifying the contents
  - Designers have a limited support during the specification of facts, dimensions, and measures

Demand-driven (Requirement-driven) DM Design/1



Demand-driven (Requirement-driven) DM Design/2

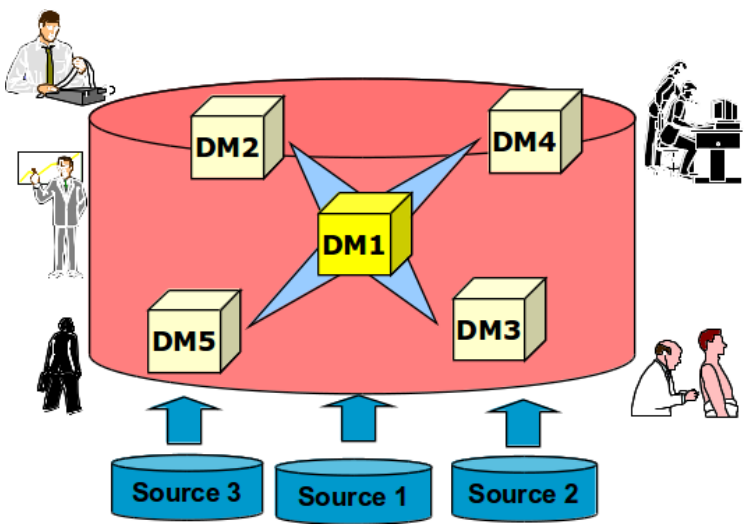
- Approach
  - Begin with the definition of information requirements of DM users
  - The problem of how to map those requirements into existing data sources is addressed at a later stage
- Pros
  - User requirements play a leading role
- Cons
  - Designers need strong leadership and mediation qualities to properly integrate different viewpoints
  - Required data might not be available in data sources
  - In general more time intensive since users do not have a clear understanding of the business goals

Mixed Approach to DM Design

- Requirement and data source analysis are done at the same time
  $\rightarrow$ user requirements
  $\rightarrow$ reconciled layer
- User requirements help to reduce the complexity of the reconciled layer
- Mixed approach is typically the best solution

The First Data Mart

- Is the one playing the most strategic role for the enterprise
- Should be a backbone for the whole DW
- Should lean on available and consistent data sources



Outline

1 Methodological Framework to Build a DW

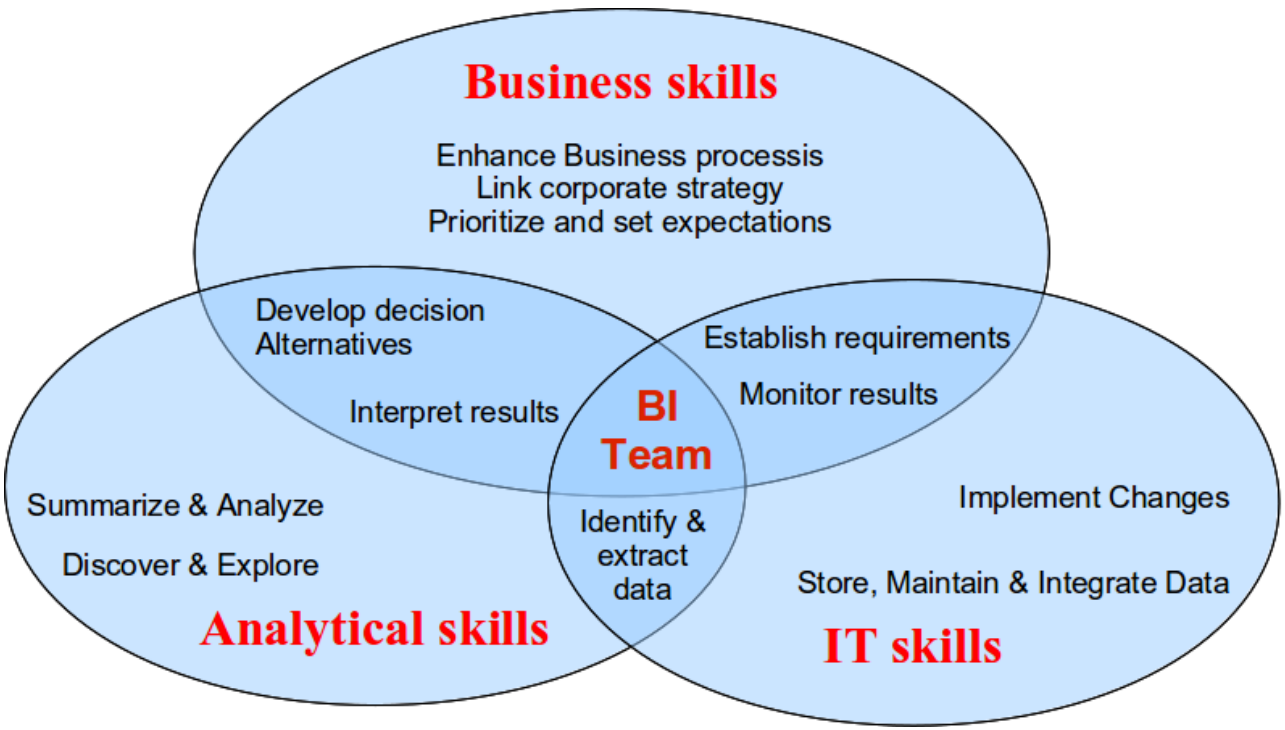
2 DW Project Management

DW Project Management

- DW projects are large and different from ordinary SW projects
- 12-36 months and \$1+ million per project
- Data marts are smaller and safer (bottom up approach)
- Reasons for failure
  - Lack of proper design methodologies
  - High HW+SW cost
  - Deployment problems (lack of training)
  - Organizational changes are difficult (new processes, data ownership,...)
  - Ethical issues (security, privacy, ...)
- Creation of a Business Intelligence Competence Center (BICC) is crucial for success

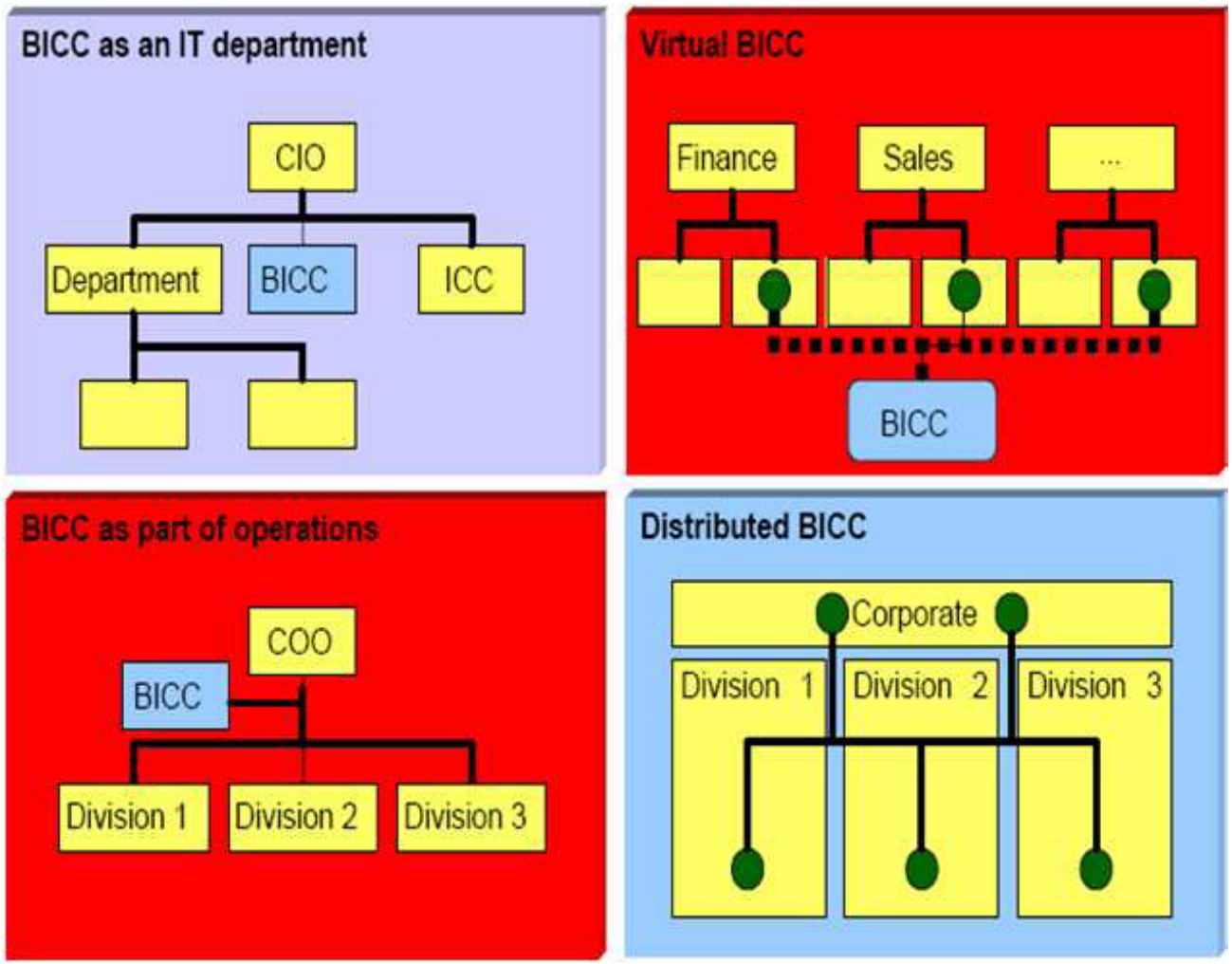
Business Intelligence Competence Center (BICC)/1

- Combines competences from different but crucial sectors
- Leads and is responsible for the DW project



Business Intelligence Competence Center (BICC)/2

- BICC requires a change in the organization (difficult!)
- No best place, but has strategic importance



Summary

- Building a DW is a complex task
  - There is a lack of experience and of a methodological framework;
  - Top-down versus Bottom-up design
  - Supply-driven versus demand-driven DM design
  - First DM plays a crucial role
- Life-cycle of DW: goal setting and planning, infrastructure design, iterative design and development of DMs
- Creation of a Business Intelligence Competence Center is crucial for success.