DATA PROCESSING MODELING IN DECISION SUPPORT SYSTEMS

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Introduction

Due to the advancement of both, information technology in general, and databases in particular; data stored devices are becoming cheaper and data processing speed is increasing.

As result of this, organizations tend to store large volumes of data with holding great potential information.

Decision Support Systems (DSS) try to use the stored data to obtain valuable information for organizations. They try to extract the information processing of data in a certain way; allowing managers to make decisions and predict future trends.

"Predicting the future by studying the past."

We propose a methodology to develop DSS in the Analysis phase, respective of data processing modeling and following Software Engineering processes.
Motivation

One of the challenges of Software Engineering (SE), is to propose:

- Rules, process, guidelines and models that address Software development:
  - Quickly, efficiently, and in a specific and unambiguous manner and resulting in a quality product.

Motivation

The techniques mostly used in Software Engineering are:

- Data modeling, proposes structures to store the data efficiently.
- Use Cases (UC), allows modeling the functionality of a software system at a high level of abstraction.
Motivation

**On the one hand**

Decision Support Systems are based upon historical databases containing large amounts of data.

However, these systems are not always based on databases built for this purpose, which we don’t consider efficient.

We believe the Decision Support Systems must be based on data warehouses (DW), or multidimensional databases; and following specific multidimensional (MM) data models.

**On the other hand**

The User Cases are almost always used in a particular way for each system.

*They are "tailored" by the applications that they model.*

We think it would be desirable to have User Cases *"patterns"* that could be reused by most systems that need the same functionalities.
Objectives

We wish to show a general reusable User Case, as a “pattern”, which may be used as a guide in the development of Decision Support Systems to model the data processing functionality.

Also using specific multidimensional data models.

Proposal

We will use data models and User Cases to propose a guide for development of DSS; proposing:

- Using appropriate conceptual MM data models that reflect the basic starting data required to develop a DW or Multidimensional Data Base.
- Using a Use Case “pattern” to represent the functionality of any DSS, regarding data processing.

This will allow us to reflect how to obtain derived data, dynamically and automatically, necessary for any analysis.
The MM models should represent the data focused to analysis at the earliest stages of the DSS development.

Next, let us present the FactEntity, FE, model, which is chosen to handle the multidimensional semantics in this work.

This model also supports spatial data.
The FactEntity model distinguishes between:

- **basic data** (existing data)
- **derived data** (data obtained by processing the basic data according to the analysis criteria)

Facts and dimensions are combined to obtain the named factEntities, these can be **basic** and **virtual**.

Constructors of FE model, which also represents the functions that will be used in processing data (and also spatial representations)
A **Basic fact** is composed of basic data such as:

- A **Basic fact**, object of study
- The **leaf levels** of their associated dimensions (levels of minimum granularity)
- This is represented explicitly in the scheme

The red line surrounds the **basic data** represented in the model.
Proposal, FactEntity Model

The Rollup Operator:

Is used to navigate between the hierarchical levels

The processing data:

Produces Virtual factEntities which are generated when the Rollup operator is applied.

Virtual factEntities are composed of derived data, such as:

- Derived facts (The functions represented in the diagram on fact measure are applied)
- Cartesian subgroups of their associated dimensions, where at least one dimension is involved with a level, greater than leaf level

These are not represented explicitly in the scheme, but... The necessary elements to generate them, in an automatic way, are represented.
When, we perform a Rollup over the dimensional levels and we apply the functions represented in the diagram on fact measures, we obtain the Virtual factEntities or derived data.

**Proposal, USE CASE, UC**

Next we will show the generic User Case model proposed to gather:

Decision Support System functionalities in regard to the processing of basic data.

To develop this UC we have used:

- The data model **FactEntity**
- The Gascueña algorithm
Proposal, USE CASE, UC, Diagram

Here we can see the *Generate Virtual factEntity UC*, and four associated Use Cases, which show different ways of stored the virtual FactEntities generated:

![Diagram of Generate Virtual FactEntities]

Proposal, USE CASE, UC, Diagram

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Conclusions

In this paper we have proposed a methodology, which attempts to serve as a generalized guide for the development of DSS following the Software Engineering guidelines.

Our proposal is framed within the Analysis phase of the software development process life cycle.

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