

Temporal extension of an object-oriented information system about hospitals

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CERES – An information system about hospitals

Interested user groups (e.g. potential patients or healthcare professionals) want to access concise historical information about all hospitals in Germany. Unfortunately, only yearly reports published as PDFs are available at the moment.

That's why the CERES project aims to create a free information system which offers data of all German hospitals in a comfortable and unified way (Fig. 1).

The developed system is web-based system and uses a object-oriented database.

The database schema (Fig. 2) is intentionally without temporal aspects.

- Simplified modelling process
- Intuitively understandable schema

However, access to historical data is the key to the in-depth analysis of a hospital, so a temporal object-oriented database system is required.

CHRONOS – A temporal database system

Only very few research has been conducted in the framework of object-oriented databases. Furthermore, all-purpose temporal DBMS are highly complex systems with a multitude of new concepts and features.

There are also several technical pitfalls when adding a temporal dimension, e.g.

- Inefficient query evaluations
- Explosion of the space occupied by the database

To avoid these problems, a temporal DBMS called CHRONOS was developed

- CHRONOS does not try to provide a solution to the general case.
- CHRONOS is tailor-made to the actual needs of the potential CERES users

Tailoring CHRONOS

As the main approach in the development of CHRONOS is to tailor the system precisely to the needs of potential users, a considerable effort was devoted to the requirement analysis.

The actual analysis phase is preceded by an exploration phase [1]:

- It guarantees openness towards new and unexpected aspects and ideas.
- It utilizes methods from the empirical social research and consists of preparation, conduction and analysis of semi-structured interviews [2].
- Analysis: Qualitative data analysis methods and methods that are employed in goal-oriented design approaches, e.g. personas, goals and scenarios [3, 4].

The results formed the basis for the system requirements and therefore the system design (Fig. 3).

Results

The analysis of the semi-structured interviews revealed that potential CERES users only require very basic temporal selections. For example:

- no realistic scenarios exist that would require the formulation of interval relations as described in Allen's temporal logic,
- no need to provide data restructure or aggregation features. Most data is already summarized and there is a view manager providing these features.

Using the analysis results, CHRONOQL – a temporal extension of the language OQL – was designed as a very lean and efficiently evaluable query language.

Thanks to the structure of the existing CERES architecture, CHRONOS can easily be integrated into the existing system by adding new components or replacing non-temporal ones (Fig. 4).

Conclusion

Adding temporal support to database management systems in order to overcome the problem of increasing data and program complexity is a widely accepted approach and has been extensively researched for over two decades, although mostly in the context of relational databases [5].

CHRONOS follows a new approach by intentionally leaving out all features that have been identified as dispensable by means of the requirements analysis. The resulting temporal framework is lean and easy to understand and to use.

CHRONOS is a back-end application and therefore concentrates on how historical data is stored and made accessible to other applications. To fully profit from the benefits of a temporal database, the CERES project has to upgrade the existing front-end tools and to develop new temporal applications. CHRONOS supports these steps by providing a lean and robust temporal framework and an efficient implementation of temporal aspects.

References

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FIG 1.
PROTOTYPE
WEBPAGE
Hospital data
presented by using
tables and a
navigation tree

FIG 2.
DATABASE
SCHEMA

UML diagram of
the database
(Extract)

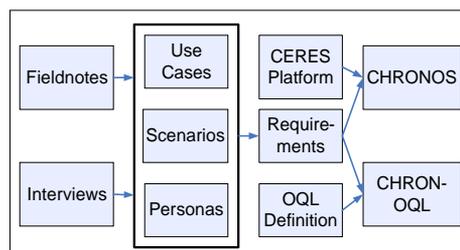
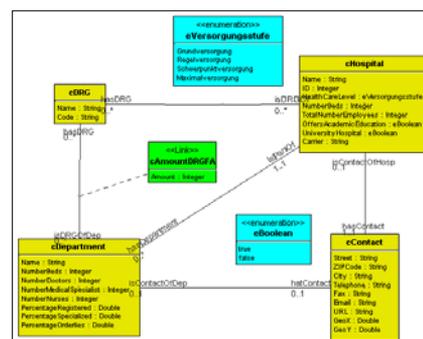


FIG 3.
REQUIREMENT
ANALYSIS
Materials and methods
used in the requirement
analysis for CHRONOS

FIG 4.
ARCHITECTURE

Components of the
CERES Information
System. The dark blue
modules
belong to
CHRONOS.

