Informatics

Diplomarbeitspräsentation

electronic commerce

Persistence of workflow control data in temporal databases

Masterstudium:

Business Informatics

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Utilizing temporal DBMS in BPM

Conventional database systems do not adequately support the handling of time-related data. In particular, querying data in conventional database systems with regard to time-related aspects can be complex and associated with long run-times during execution.
Temporal databases offer e.g.

- various kinds of time oriented query statements
- specialized data types
- a more applicable data organization of temporal data

Eventhough temporal workflow management systems are heavily built on temporal data, hardly any is built on a temporal database.

This work examines, if the use of temporal databases in context of business process management can be beneficial. As temporal database, a PostgreSQL extension by Dignös, Böhlen, Gamper and Jensen was used [DBGJ16].

Example on how to query process execution data in temporal SQL:
“Periods of parallel task execution of talking and printing.”

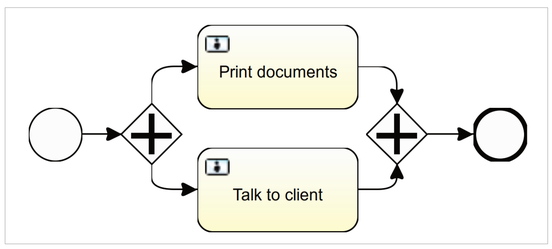


Figure: Example BPMN 2.0 diagram

```
SELECT * FROM ACT_HI_TASKINST_
WHERE ID_ = 'print'
INTERSECT PERIOD
WITH ( start_time_, end_time_ )
SELECT * FROM ACT_HI_TASKINST_
WHERE ID_ = 'talk' ;
```

Methodology

As a basis for the evaluation of the processing of time-related data in a standard and a temporal database, thirteen BPM-relevant queries were identified and implemented in standard and temporal SQL.

To determine the complexity of query statements, Halstead complexity metrics were calculated [Hal77] based on

- total number of operands and operators (length)
- distinct count of utilized operands and operators (vocabulary)

Amongst others, the following metrics have been calculated:

- effort to implement or understand a statement (proportional to the number of operations performed and operands utilized)
- difficulty level (proportional to the count of distinct operators)

Within a benchmark application, the performance of querying process execution data was compared. Therefore, differently sized data sets have been generated within a simulation application, utilizing the Activiti workflow engine and its underlying data model.

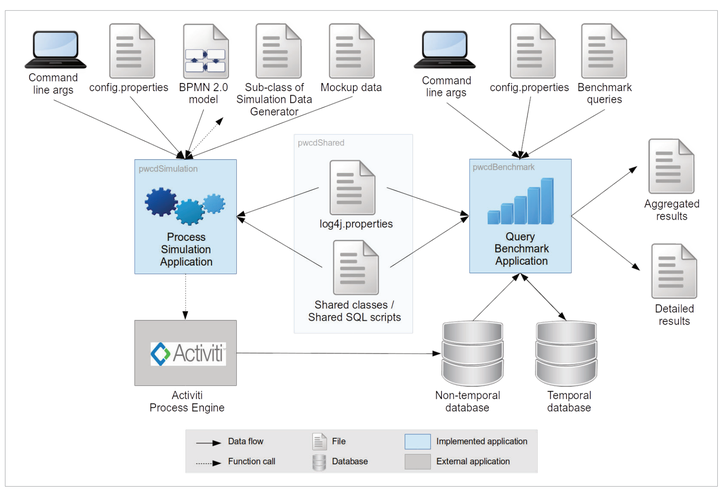
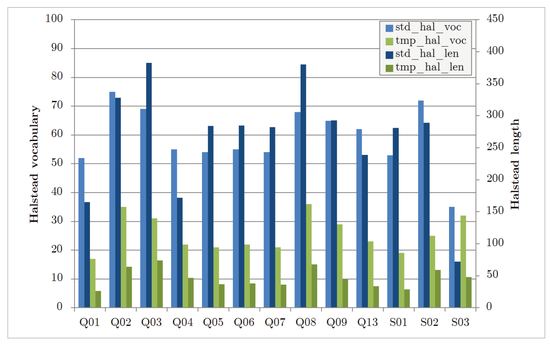


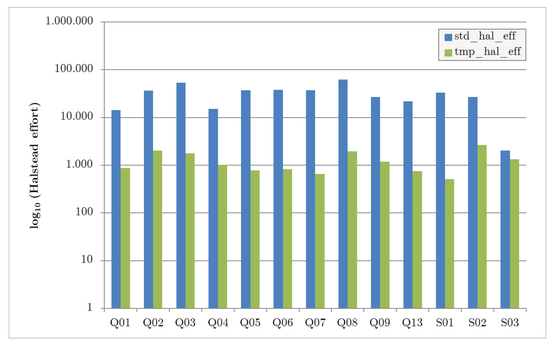
Figure: Application architecture (schematic)

Results - Query complexity metrics

The temporal database allows a much easier retrieval of period related data. The database queries written in temporal SQL are significantly shorter and less complex.



(a) Halstead length and vocabulary

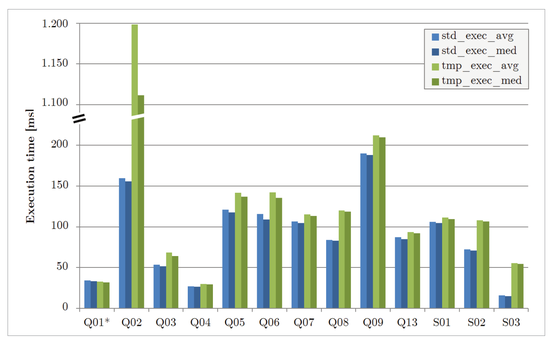


(b) Halstead effort

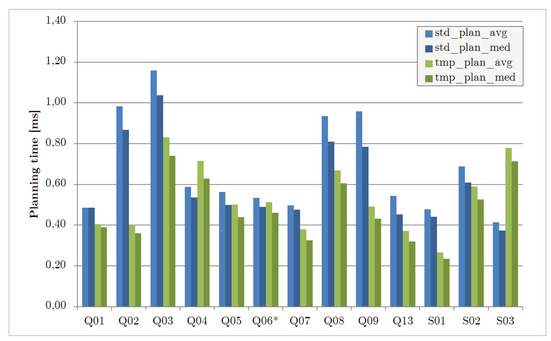
Figure: Halstead metrics length, vocabulary and effort for queries in standard and temporal SQL.

Results - Query execution performance

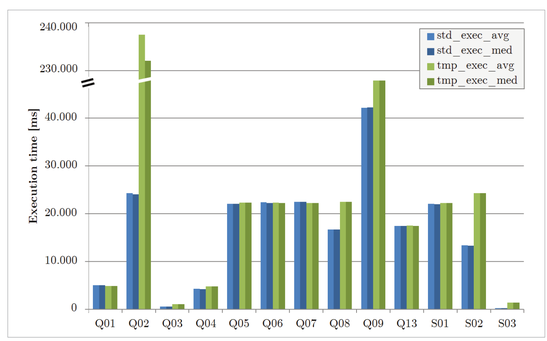
Eventhough a better execution performance (lower query planning and execution time) in the temporal database could be observed for certain statements, no general advantage could be identified.



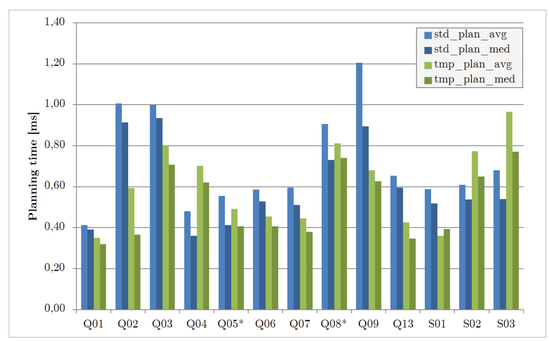
(a) Query execution times / data of 250 simulated process iterations



(b) Query planning times / data of 250 simulated process iterations



(c) Query execution times / data of 4,000 simulated process iterations



(d) Query planning times / data of 4,000 simulated process iterations

Figure: Average and median query planning and execution times of query processings on different sized data sets of process execution data. Non-significant differences are marked with *.

References

- Anton Dignös, Michael H. Böhlen, Johann Gamper, and Christian S. Jensen.
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