

BRIEF DEVELOPER'S CONCEPTION OF INFORMATION SYSTEM FOR SOFT REAL-TIME PROCESSES



ICT PRAGUE

Case study included
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Introduction – today's TIS

There are plenty of complex technological-information systems (TIS) on today's market. These systems are covering all needs of industrial automatization. However, these robust TIS are very expensive and totally integrated, which means unsuitability for using on campus environment.

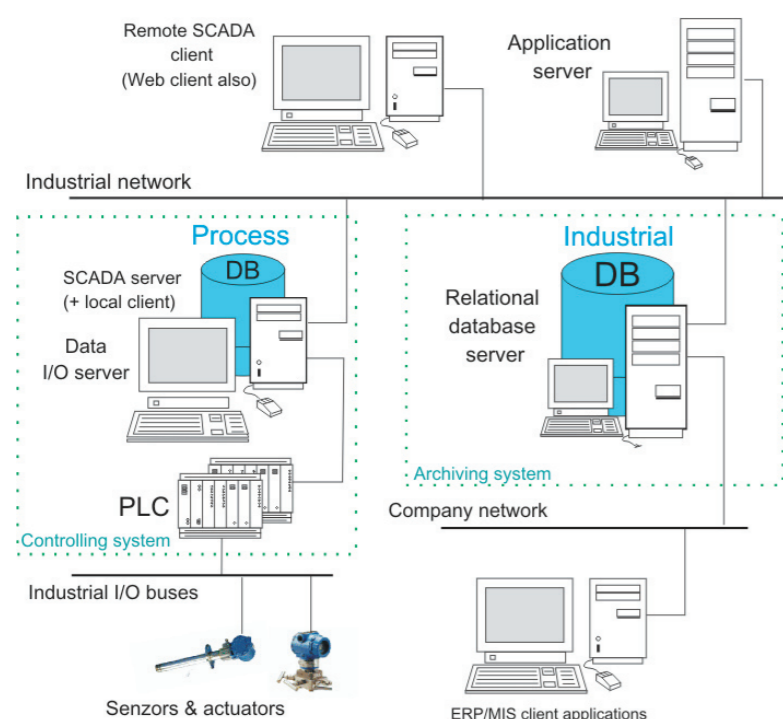


Fig. 1. Generalized architecture of TIS

Heart of TIS is process and industrial databases:

- **process database** - near history of process data
- **industrial database** - full history of process data

Main questions, which we'd like to clarify, are:

- How to select suitable combination of database software, operating system and hardware?
- What do we know about information's journey from sensor places to database?
- Which information from process do we want to store in the database?
- What algorithms associated with database do we want to use?
- How to design and create physical structure in database environment?

Conception overview – databases in TIS

Suitable combination of software and hardware

Hardware (HW) requirements

- branded articles for fast&stable framework
- fast processor(s), large system memory
- fast I/O operations - RAID arrays

Software (SW) - operating system (OS)

Linux / Unix	Microsoft Windows
stable & open OS	compatibility
small system cost	user-friendliness

Tab 1. Advantages of two operating system

What do RDBMS and RTDBMS acronyms mean?

- **Standard database system (DS)**
 - database management system (DBMS)
 - database (DB)
 - **Real-time database systems (RTDBS)**
- In developer's point of view there are two DS:
- **file-databases**
 - **client/server databases**

The most frequent DBMS is **relational database management systems (RDBMS)**. Generally, **RDBMS aren't** suitable for real-time process data archiving, *but* depend upon number of variables and requisite period of storing. *So, why not try to use classic RDBMS for small soft real-time process?*

Process data for storing to database

- **dynamic data** – process variables
- **relatively static data** – process parameters
- **other information** (e.g. user notes, alarms, ...)

Two option/methods for data archiving:

- **cyclic** - *period* of cyclic archiving
- **change** - *thresholds* in value&time scope

Algorithms associated with databases for:

- data archiving
- process controlling
- on-line calculations
- variable conversions

Relational database-model building

Database objects like:

- **database instance, datafile and tablespace**
- **database users, their workspaces & roles**
- **database tables, views, functions & procedures**
- **data types & precision, database constraints**

Case study – databases in TIS for small soft real-time system

Short description of original TIS

Laboratory station, climbing film **evaporator unit** was equipped with a control system consisting of PLC and supervisory PC running visualization and data acquisition software **TomPack** (ProjectSoft, CZ).

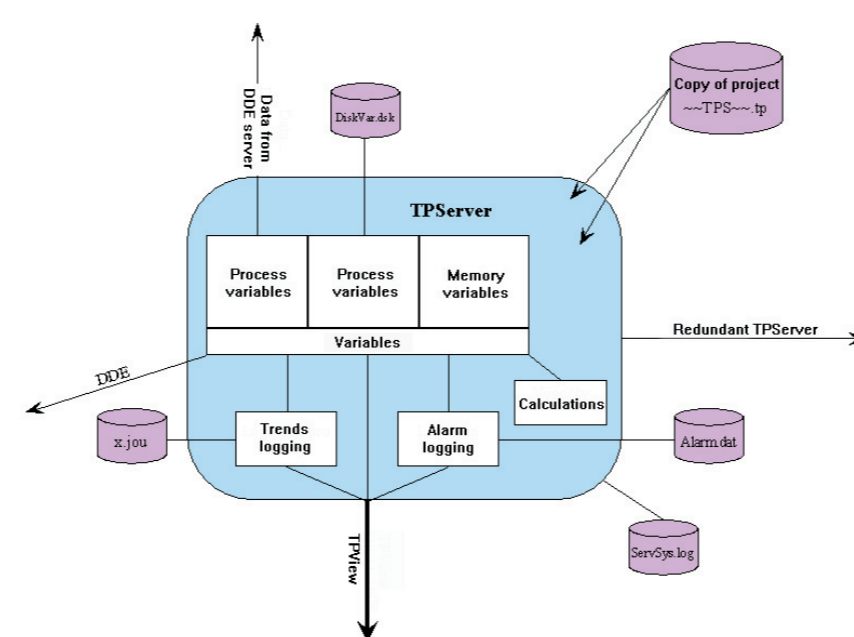


Fig. 2. TomPack system architecture, ProjectSoft

Database structure

- **Control data section**
 - all executive database objects & sync. tables
- **Experimental data section**
 - *Experiment* - exper. description
 - *Value* - dynamic process values
 - *Notes* - user notes with timestamps
- **System data section**
 - *Senzor* - sensor details
 - *Location* - sensor locating on evaporator
 - *Measurement* - measurement type/each sensor
 - *Variable* - variable-unit pairs
- **Physical-chemical data section**
 - *TOC* - descriptive table for remaining tables
 - *Table1, Table2* - physical-chemical data sheets

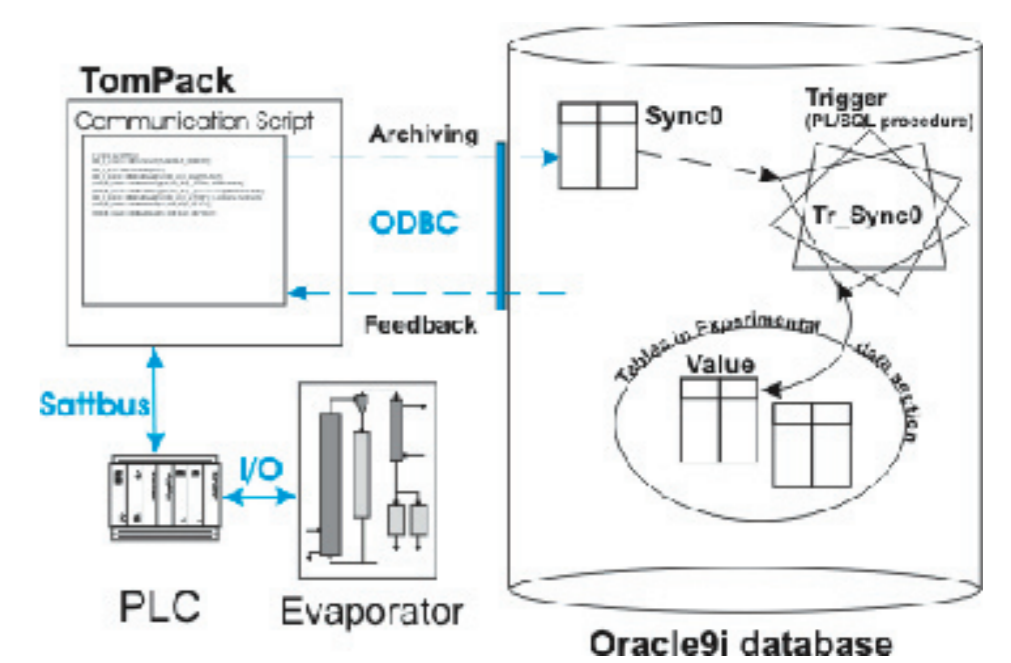


Fig. 6 On-line data archiving- data flow schema

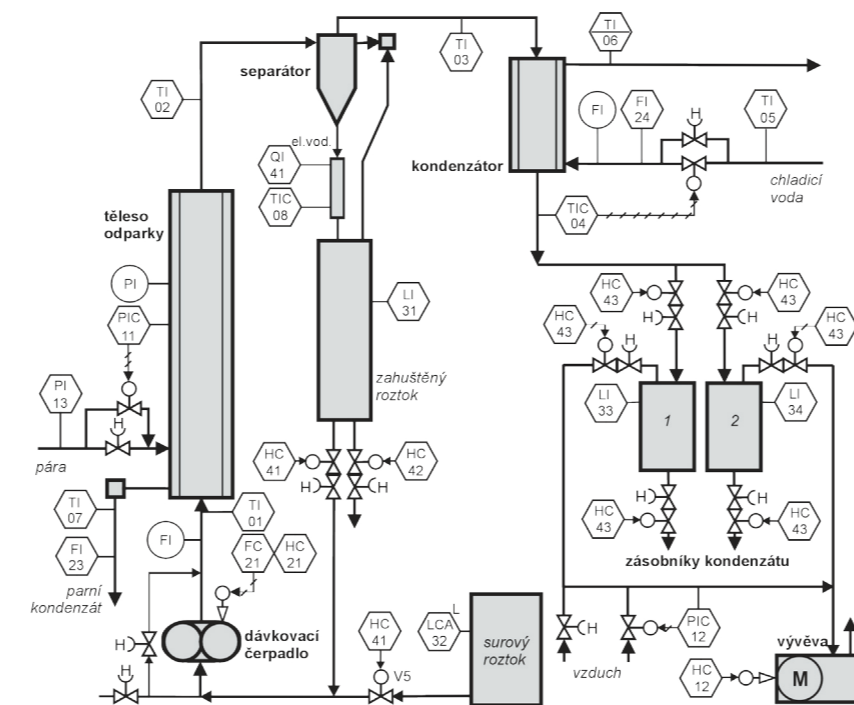
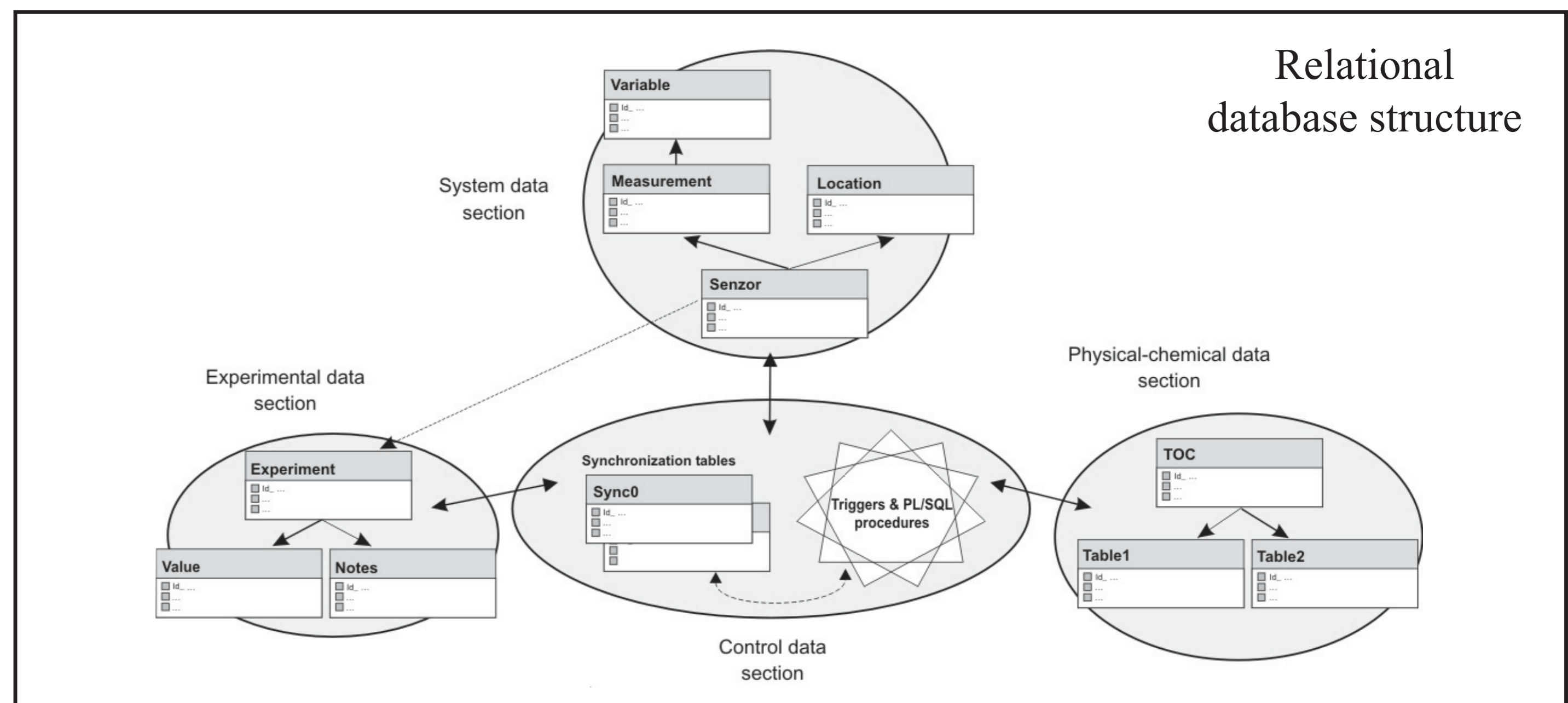


Fig. 3 Measurement and control circuits of laboratory evaporator

Algorithms for on-line computing

On-line estimation of concentration of the sugar solution based on two measured variables: the boiling point of sugar solution and the evaporator pressure.

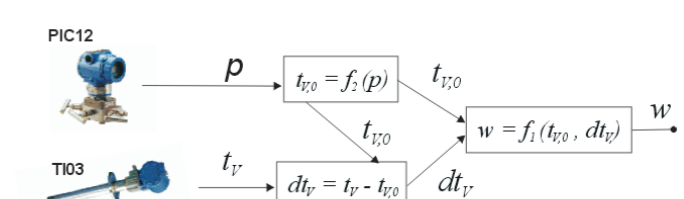


Fig. 7 Algorithm - block diagram

Conclusion

We built up a suitable combination of original technological-information system and database server for process data storing. Designed relational structure of database for real-time archiving was successfully tested under semi-plant scale conditions. Our TIS is able to store nearly twenty measured – dynamic process variables in 5 seconds cycles without any problems. It is also able to on-line calculate unknown quantity based on measured and tabulated variables (stored in Oracle database). In the next phase, we would like to expand our TIS for relatively static variables – system parameters and create user-friendly environment for data publication & exporting to third party applications.

References

- Polnický, J. (2002). *On-line databáze procesních dat pro laboratorní odparku (Diploma thesis)*. ICT Prague.
- Kmínek, M. (2001). *Měřicí a řídicí technika*, ICT Prague.

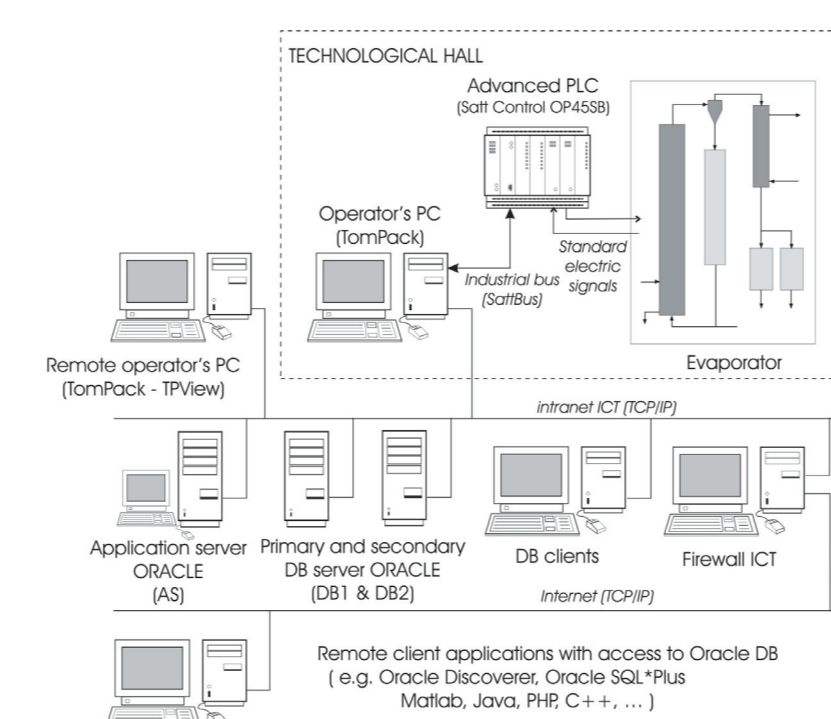


Fig. 4. Communication architecture in TIS

Three servers for different purposes in one intranet:

- **primary database server** - operator's computer
- **secondary database server** - database clients
- **application server** - applications, data publishing