The challenge

The digital transformation of our economy is advancing with giant strides and posing new challenges for industry. The increasing use of automation in machine and plant construction has inevitably led to more industrial production processes being recorded and monitored by sensors. As a result, it has become more important than ever for industry as a whole to ensure that specific data from controlled processes is not only linked together as well as possible but also that it can be integrated with external sources of information. A central evaluation of the vast quantities of data generated in these processes yields the potential of facilitating the optimisation of internal processes and a drastic reduction of production and maintenance costs. Unfortunately, the most commonly used data analysis tools are simply not able to deal with such large amounts of real-time data.

Research for Industry 4.0

The aforementioned challenges are the reason why science and industry are now working together on the »Semantic Analysis of Complex Events« (SAKE) project. The goal of the project is the development of a framework for the analysis of large and complex industrial data. Central to SAKE is the design, implementation and evaluation of a modular platform capable of integrating and processing the large and diverse event data streams required in engineering and IT monitoring systems. The project relies on the latest data processing technology as well as new Linked Data methods and standards to achieve these goals.

Practical use cases provided by the industrial partners involved in the project are used to generate the SAKE platform requirements. The resulting technology modules will be evaluated by the partners at a later stage.

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Use case: Printing systems

Today’s printing industry is dominated by large, global printing companies capable of processing orders of any size quickly and efficiently which has led to an increased demand for more reliable printing systems. The Heidelberger Druckmaschinen AG are using SAKE as part of a preventive service to optimise their efficiency.

Central requirements are:
- The development of an automatically generated algorithm which uses a trigger point (i.e. error time) within the log file data of a printing system to describe causal connections
- Setting up a knowledge base which automatically processes, structures and anonymises messages for service technicians

Use case: Turbo compressors

Gases are an essential component of many industrial processes and are used in a variety of quantities and states. Compressors are used when gases are required to be at a certain pressure.

Because of the sensors’ high sampling rate combined with the large number of sensors installed per machine and the quantity of machines themselves, the volume of data generated and requiring evaluation to enable the safe operation of compressor plants is vast.

In order to avoid unwanted operating conditions the AviComp Controls GmbH offers machine monitoring systems which are to be optimised using SAKE.

Central requirements are:
- Early detection of impending maintenance issues
- Long-term measurements and analysis based on database evaluation
- Remote connections of a machine monitoring system to a dedicated machine state analysis or failure prognosis

Use Case Application Monitoring

It is typical for complex business applications that an efficient execution of tasks highly depends on the user’s experience. By monitoring the user’s behavior it is possible to support the learning progress, to avoid inefficient use, or to allow an early detection of misuse. USU Software AG intends to utilize the SAKE platform for monitoring, scanning, analyzing, and visualizing large-scale historical data as well as streaming data to provide an appropriate guidance of the user.

Central requirements are among others:
- Learning of efficient task processing based on the profiles of experienced users.
- Predictive failure detection and prevention.
- Automatic generation of optimal user actions.

Technical innovations

SAKE’s most important technical innovations are:
- Development of a scalable distributed data storage layer relating to event descriptions in accordance with the Resource Description Framework (RDF)
- Distributed similarity calculations for linking event data
- Efficient supervised and unsupervised machine learning modules for modularised data to discover the causes of errors and to predict sensor configurations which can lead to errors
- Design and development of RDF-based time frame and correlation analysis processes
- Development of intuitive user interfaces

Project consortium

- AviComp Controls GmbH
- Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS
- Heidelberger Druckmaschinen AG
- Ontos GmbH
- Leipzig University
- USU Software AG