ITEA3

Project Results

Reflexion

## The next step in utilising high-tech systems data

EXECUTIVE SUMMARY

The ITEA project Reflexion (React to Effects Fast by Learning, Evaluation, and eXtracted InformatiON) assisted high-tech systems companies in using operational data to improve the development lifecycles, maintenance and troubleshooting of products. Using open source frameworks, self-learning and data-analysing systems were developed that accumulate useful knowledge during a product's lifetime, resulting in a faster time-to-market, lower costs and greater competitiveness.

PROJECT ORIGINS

Integrating operational data into a product's development lifecycle is the next step forward for the high-tech systems manufacturing domain. However, as industry increasingly shifts towards complex, digitised systems in which all components produce data, R&D remains largely dependent on legacy engineering choices. Typically, more than 20% of R&D budgets are spent on issues caused by poor quality, sometimes amounting to over 5% of total turnover. Industry executives are thus in an 'awareness' stage: while there is an understanding that data can lead to improved processes, less is understood about the necessary roadmaps to get there. Many companies now operate data pipelines to send information back to headquarters, yet this data is often low quality and delivers no value in generating new business models. Domain-specific knowledge and data science must be combined.

Reflexion's success lays not in a product – a non-existent 'silver bullet' to be applied in all circumstances – but in integrating pre-existing frameworks to improve consortium partners' processes. There are a wide number of open source frameworks that specialise in data science, backed by huge communities. Through Reflexion, high-tech systems companies were exposed to these frameworks, helping them to understand what exists and how it can be used to improve their own data management. By augmenting their products with an introspective layer of data sensing

Reflexion data processing architecture supporting system engineering on data insights
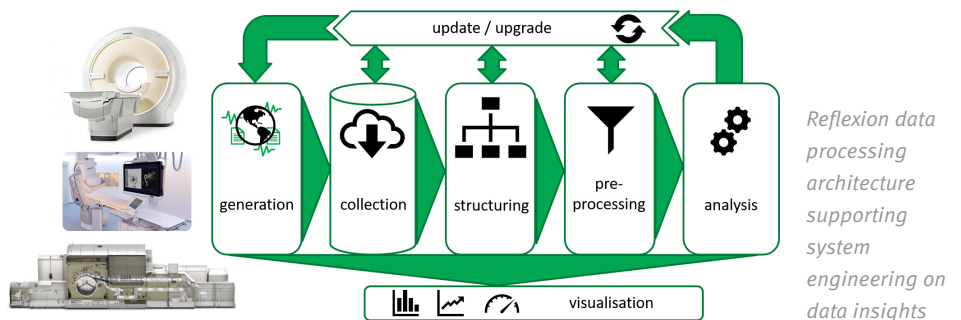
and analytics, partners had the opportunity to valorise their operational data and to propagate newfound knowledge back into the development cycle, services and maintenance. Additionally, the Reflexion consortium created system-data demonstrators showing how operational data benefits high-tech systems companies, speeding up the transition from the 'awareness' stage to greater exploitation.

TECHNOLOGY APPLIED

Reflexion utilised free, readily available open source frameworks as the basis for data processing, including Elasticsearch, Logtash, Kibana, Jupyter, Scikit-learn and various Apache stacks. These frameworks were connected to industry data and used to develop models that correspond to each company's needs. For instance, Siemens Industry Software developed a potential service model based around simulated failures, which can predict future issues even in the absence of 'real' data. Across all industry

partners, there has been a boost in cockpits for processing high-tech system sensor data and visualising it effectively. Furthermore, they all have improved their data pipelines to the point of returning only useful information, which means that gathered information can be used to automatically enhance future product design, demonstrating the direct link between operational data acquisition and improved product design.

Additionally, the use of open source technology represents a move towards greater standardisation of diagnostic frameworks and away from legacy proprietary choices that limit the true harnessing of data. Mutual collaboration between industry and technology providers made it easier to analyse system behaviour, exposing deficiencies that are found to not improve performance. For Philips MR this means for example that products can skip specific certification and validation of features that are thus deemed unnecessary.

A major takeaway for partners is that there are no generic approaches. Serious modelling and domain insights are needed to choose and develop the correct frameworks with which to conduct analysis.

MAKING THE DIFFERENCE

Regarding industrial impact, Reflexion has focused on specific high-tech systems domains and has seen enormous boosts in these areas. In particular, 25 data science jobs have been created within partners, all of which will continue Reflexion's agenda. Others working with the systems are now also equipped to utilise data to create better products within a smaller timeframe. In concrete terms, Océ has improved their mean time to repair (MTTR) for all new machines by 50%, while SynerScope saw a 30% reduction in time spent troubleshooting. For Barco and TNO, new business models are expected to be worth 20 million euros in the next 5 years.

Some partners improved products with important effects for wider society. Philips and Barco, for instance, can now create medical equipment with a higher uptime, meaning the possibility to diagnose or operate on more patients per day.

They developed technology generating test-suites which cannot be distinguished from real-life user tests, opening up the potential to make systems (and therefore users) safer against threats for which no data currently exists. Finally, lower development, maintenance and troubleshooting costs mean a better price-to-quality ratio for customers. SynerScope's visual-analytical tooling enabled their customer Stedin to plan with a 99,5% accuracy first-time-right smart meter installation visits, saving an effective 40 FTE in the smart meter rollout for the Netherlands.

As Reflexion represents the first step in an ongoing revolutionisation of high-tech systems development, TNO, Océ, Philips and Siemens Industry Software will continue their cooperation in the ITEA project OXILATE. Together with several new partners (e.g. Valmet Automation, M-Files, Intopalo Digital, CP Kelco and SII Concatel), they will implement Reflexion's successes throughout complete product lifecycles, integrating data in professional services, support and down the entire value chain. This highlights a wider shift in industry behaviour that will increasingly improve efficiency and competitiveness in the future.

MAJOR PROJECT OUTCOMES

Dissemination
- 4 conference papers, 3 articles, 7 master thesis, 7 invited talks, 7 workshops, 7 demos at innovation markets

Exploitation (so far)
- Siemens ISW Simcenter Dx prototype to train machine learning algorithms with simulation-generated data & cloud-based virtual twin approach for drivetrain fleets
- Barco Nexxis Care Plan web portal for Barco distributors, resellers and system integrators to manage their installed Barco products
- Océ ODAS tool suite to support the Océ R&D engineering community
- Philips Performance Bridge utilization dashboard for MR systems piloted at first customers
- SynerScope new product releases of Ixiwa (self-service data lake) and Iximeer (data analysis tool) integrated into one coherent tool solution
- Extension of the Axini TestManager user profile driven MBT engine prototype, generating test-cases following the same distribution & characteristics of real users interacting with the system
- Extension of the Yazzoom Yanomaly big data platform for anomaly detection on machine-generated data & Yasense virtual sensor tool suite
- TNO systems data expertise groups targeting the high-tech systems industry, knowledge roadmap addressing industrial challenges with respect to emerging data

Standardisation & open source strategy
- Reflexion partners contributed additions, improvements and bugfixes back to existing open source communities like: Apache Kafka, pandas, Python, Elasticsearch, Filebeat, Hadoop stack

Spin-offs
- ITEA OXILATE project
- Secured 25 data science specialist positions for industry

Reflexion
14035

Partners

Belgium
Barco
Siemens Industry Software
Yazzoom

Netherlands
Axini
Océ Technologies
Philips
SynerScope
TNO

Project start
September 2015

Project end
February 2019

Project leader
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Project website
http://esi.nl/research/research-in-projects/reflexion.dot