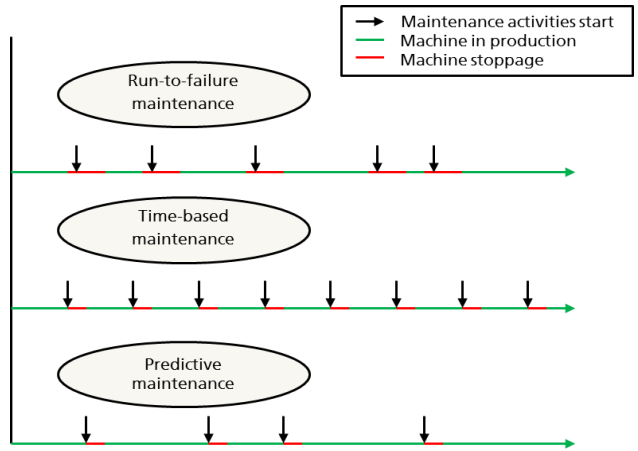
Motivation

In both theory and business practice there are mainly three different maintenance strategies:

- **breakdown (run-to-failure) maintenance strategy,**
- **preventive (time-based) maintenance strategy,**
- **predictive maintenance strategy.**



From Run-to-failure to Predictive maintenance

The **breakdown maintenance strategy** allows the machinery to run to failure. Consequently, it requires a large inventory of spare parts and is therefore the most inefficient way of maintenance.

The **preventive maintenance strategy** schedules maintenance activities at predetermined time intervals. Thus components without any functional failure are replaced and production time is reduced.

Substantial productivity gains can be achieved by implementing a **predictive maintenance strategy**, which monitors mechanical and operational conditions in-line. Maintenance activities are exactly triggered when failure has been detected to be imminent. However, predictive maintenance still has to meet many challenges and especially condition monitoring systems of forming presses are rarely published in literature. Therefore, iMain aims developing a novel decision support system for predictive maintenance with focus on press machines.

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iMAIN PROJECT

A NOVEL DECISION SUPPORT SYSTEM FOR INTELLIGENT MAINTENANCE

This project has received funding from the European Community's Seventh Framework Programme under grant agreement no 314304.

iMain Concept

iMain is a European level research project aiming to develop a novel decision support system for predictive maintenance.
It is supported by EU with EUR 3 433 448 funding and has a duration of 36 months, beginning on 1st of September 2012. For the success of the project 8 partners from 4 European countries work together.

Our objective is to develop a novel and advanced concept with a practical verified solution for an information-based predictive maintenance system which will include:

- An **embedded condition and energy monitoring** (ECEM) system, which will operate autonomous and self-sufficient.
- A smart **service life prediction system**, that will extend the ECEM system with additional simulated "virtual" sensors.
- A novel **e-maintenance** strategy involving distributed cloud based services and communication.

Consequently, **robust and flexible system architectures** should evolve and provide **extended capabilities** in comparison to those achievable with current maintenance practices:

- increasing system lifetime of production equipment at least 30 %,
- increasing energy efficiency at least 20 %,
- increasing availability of the whole process at least 30 %,
- decreasing maintenance costs at least 40 %.

Work packages

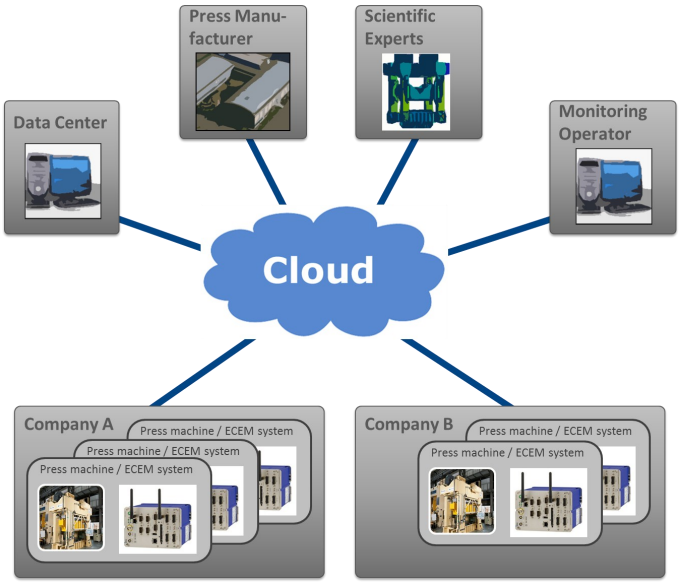
iMain project aims to develop an advanced monitoring and predictive maintenance solution for forming machines. The main focus is on the monitoring of mechanical stresses in high-loaded systems that will be evaluated primarily concerning fatigue failures caused by real loads during life time of the equipment. For this, pre-processed and reduced load and stress data will be stored in a data history and evaluated permanently concerning remaining service life using cumulative fatigue hypothesis. Model-based simulated "virtual" sensors extend the real sensor data that increase information content significantly.

To reach the goals, activities have been grouped into several interconnected work packages (WPs), directed to research and development (R&D), demonstration, management and dissemination activities.

WP1 - Advanced Condition and Energy Models will provide the conceptual framework in order to define maintenance-relevant monitoring strategies, condition and energy evaluation criteria as well as models reduction and pre-training.

WP2 - ECEM System will develop and provide the hardware and software layer for embedded measurement and processing services that integrate machine control information, wireless sensors and capabilities for real-time calculation of virtual sensors.

WP3 - Smart Service Life Prediction System will develop the necessary IT infrastructure and interface supporting the predictive maintenance decision system. To that end, several activities will be conducted in order to implement and train the conceptual prediction models developed in WP1, also developing a software module aiming at measurement accuracy and intelligent service life prediction.



Distributed condition monitoring environment

WP4 - E-Maintenance Cloud Development will be focused on the design of the overall system architecture for the e-maintenance cloud. Emphasis will also be placed on the predictive maintenance ecosystem, highlighting the interdependencies along with other enterprise resource planning services and conducting activities aimed at integrating predictive maintenance in the overall production strategy.

WP5 - Integration and Industrial Scale Demonstration seeks to develop and test robust industrial systems with the goal of advanced predictive maintenance. To that end, testing and demonstration activities will be conducted both in a hydraulic press and in mechanical press production environments.

Moreover, **WP6** and **WP7** will concentrate on the dissemination and the administrative and financial management of the project.