SMMART (System for Mobile Maintenance Accessible in Real-Time)

SMMART is a research project which has been funded by the 6th Framework Programme of the European Union since the end of 2005. It is the objective of the project to design a system which collects operative data about the state of components in real time; the data are subsequently made available for the support of the planning and execution of inspection, maintenance, and servicing activities. The focus lies on the transportation sector and comprises the maintenance and repair of LRUs (Line Replaceable Units), which are used in helicopter turbines and heavy goods vehicles. The RFID technology is applied in environments which had previously been considered as difficult or even impossible, in order to collect numerous different parameters for the monitoring of helicopter or heavy goods vehicle components and to send these to a central database in real time. All the LRUs are provided with RFID tags, so that their maintenance history, their location, and their use can be observed anytime and everywhere within a global maintenance network. The collected information is used for the prediction of future maintenance requirements, the efficient control of stocks with respect to spare parts, and a better planning of maintenance activities.

Coordinated by the French turbine producer Turbomeca, an entire number of 25 partners from ten countries are participating in the project. The ITWM's contribution is the modeling and optimization of the design of a supply chain network for maintenance activities. The strategic network design is the foundation for the development of distribution plans which guarantee the availability of the required spare parts in the right place at the right time. The starting point of the planning is the current structure of the network, consisting of different types of service centers which fulfill the customers' maintenance requirements within a very short time. Strategic planning tasks, which are supported by the network design for a time frame of up to 15 years, essentially include

- the increase/reduction of the capacity of already existing service centers

- the selection, position, and capacity of new locations for service centers

- the determination of long-term amounts of goods to be transported between the locations within the network

- the long-term assignment of customers to individual service centers.

Planning tasks of such dimensions require considerable capital expenditure, they are difficult to revise and have long-term effects. Different mixed integer linear models are developed for the formalization of these planning tasks. The basic optimization problem can only be solved by commercial solvers for small orders of magnitude. Hence, new algorithms of discrete optimization are developed in order to be able to solve problems of a dimension relevant in practice within a reasonable time. The algorithms are integrated into a software tool which enables the users responsible for the respective decisions to model different scenarios and to simulate variations.
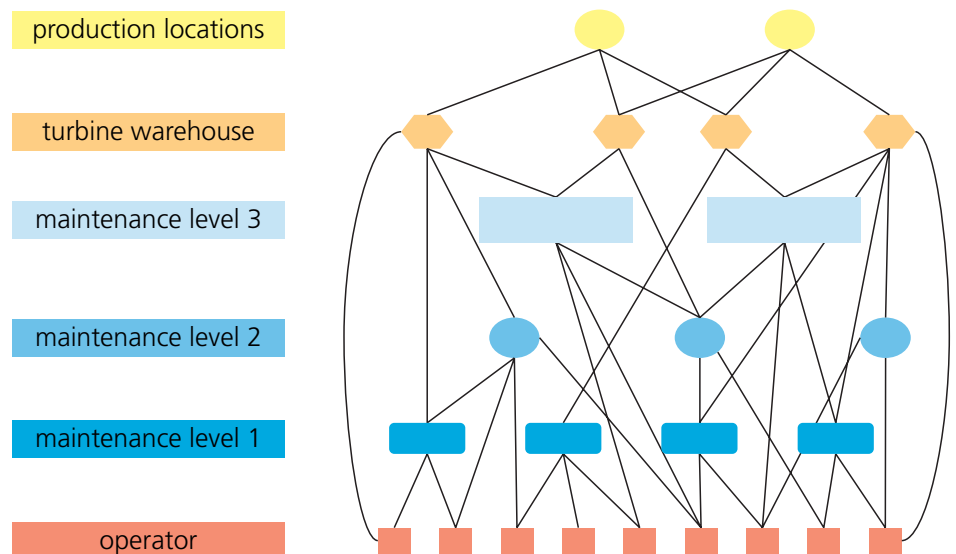
Structure of a network for turbine maintenance