# An internet-based platform for distributed after-sales services in the one-of-a-kind production

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## Abstract

Professional and innovative after-sales services are getting more and more a key success factor for companies in the one-of-a-kind industry operating with globally spread customers. Customers expect maximum use of the purchased plant and expect qualified and quick service independent of time and distance [1]. On the other hand not each company can afford its own worldwide service network and the increasing complexity of one-of-a-kind products requires a lot of specific service know-how by the service personnel. These claims call for a high grade of technical and organizational innovation by the service providers.

One possible approach is the intensification of cooperation relations between one-of-a-kind producer, customer, service partners and suppliers [2]. It is the objective of this article to describe an organisational and technical approach how small and medium enterprises can improve and extend their future service business by setting up cooperation networks. With the focus on the service fulfilment process an internet-based service platform basing on the PDM SmarTeam® and the JAVA2 enterprise technology – called E-Service Support System (E3S) – for distributed After-Sales Services used by the Buhler company will be described. The description outlines how different already available technologies can be combined to support different parties involved in the service. The paper will end with a scenario outlining the use of the service support system to solve a given customer problem.

## 1. Introduction

Nowadays new information and communication technologies allow closer cooperation to companies operating in a global environment. They allow easy and quick access and exchange of information between customers, producers and service partners independent of time and distance. Hence service processes can be designed faster and more efficient. Especially this circumstance offers great opportunities for after-sales services because

short reaction and repair time are very often essential factors for optimal use of a customer plant.

The service virtual enterprise represents such a concept (see [2] and [3]). This concept describes the organizational and technical framework for inter-enterprise collaboration in the after-sales. The suggested Internet based service platform called E-Service Support System (E3S) represents a possible approach for the technical realization of such an information system. It combines all services on a unique platform for the execution of service fulfilment and provides customer specific services based on service products.

## 2. The concept of a service virtual enterprise

With the focus on the one-of-a-kind industry, the service virtual enterprise (SVE) can be defined as "a short-term form of cooperation to fulfil services among legally independent one-of-a-kind producers, service companies, suppliers or sub-contractors in a service network of long-term duration" [3]. The services aim to provide support to the customer in the operation of their machines and installations and to solve problems as immediately and as cost-effectively as possible.

The main elements of the model are the customers of one-of-a-kind producers, the service network with the network partners, and the resulting service virtual enterprises (see figure 1). More elaborate description of this model can be found in [2] and [3] and in the paper "A Reference Model for Collaborative Service".

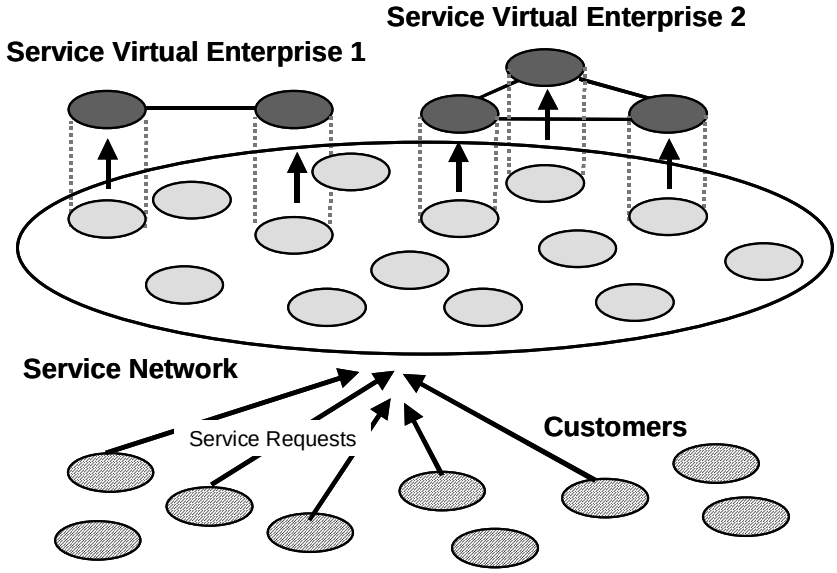


*Figure 1: Model of the service virtual enterprise*

## 2.1 Process of setting up a Service Virtual Enterprise

There are many tasks to be accomplished in order to run service business in collaboration. The fundamental processes of setting up and operating a service virtual enterprise takes on a central role. If a customer reports a problem, it is essential that suitable network partners be selected as rapidly as possible – according to the criteria of competency, location, availability, and so on – and that the service tasks to be provided are managed and controlled. The following outlines a possible schema for the proceeding that comprises four steps (see figure 2) implemented in the GERAM Model [4]. It starts with the identification and the analysis of the problem and proceeds to set-up of the SVE and fulfilment of the service and, finally, to documentation, feedback, and billing.

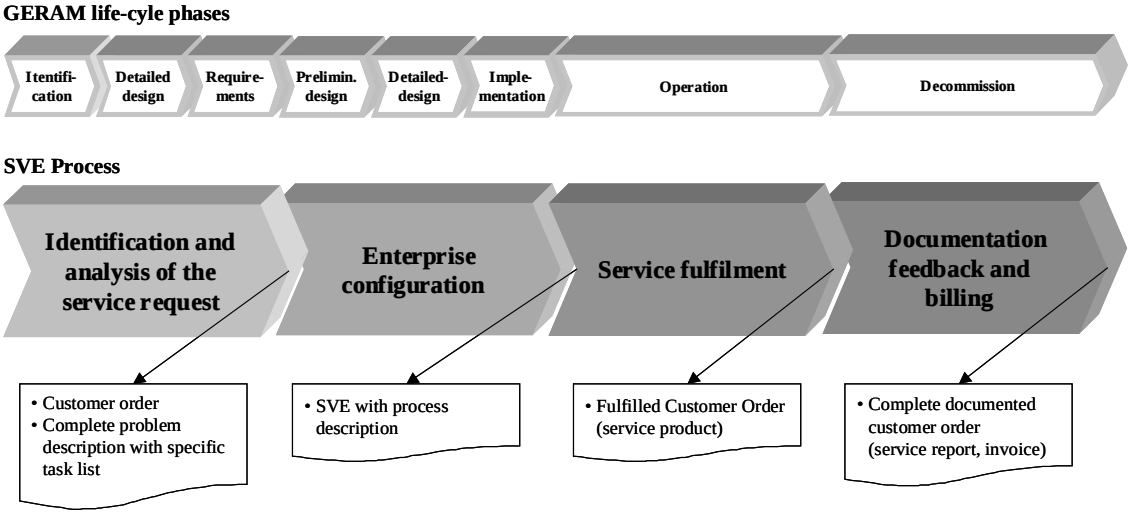


*Figure 2: Service process in a service virtual enterprise*

**Identification and analysis of the problem:** The goal of this step is to identify the problem that the customer is experiencing and to rapidly produce as accurate as possible a description of the problem. Once the problem has been identified, the measures required to solve the problem can be determined. If there is no clearly identifiable cause of the problem, measures to aid identification may be undertaken. These may include additional investigations with the help of electronic aids and systems (problem tree, diagnostic and expert systems, and so on) or on-site analysis by a specialist. Once the measures have been decided upon, a SVE is set up and contracted to provide the service (see steps 2 and 3).

**Enterprise configuration:** The goal of enterprise configuration is to set up the SVE that can best deliver the service as defined by the given requirements. Based on the results of problem identification and analysis, the service needed is broken down into individual tasks and the competencies and aids that these tasks will require are identified. Taking the network partners' capacities into account, possible SVE combinations to fulfil the tasks are worked out.

**Service fulfilment:** Service fulfilment begins with activating the necessary ICT infrastructure among the network partners involved. Depending upon the problem, service is fulfilled on site, remotely, or on-site with remote support. In the case of on-site service fulfilment – in addition to the electronic availability of information, data and documents on the machine – the possibility for mobile, online communication with other SVE partners is particularly important.

**Documentation, feedback, and billing:** After completion of the service fulfilment, the process of problem solution with all steps, utilized resources, and required time is documented. Finally, the services performed by the SVE are reviewed for quality control. If the service performed for the customer is billable (not a goodwill or warranty service), an invoice is prepared. The revenue is divided among the members of the SVE. Once the service task is completed , the SVE is terminated.

The entire service process is triggered by a service request of a customer or automatically depending on the purchased service products defined in service contracts. These services are described in the following section.

# 3. Services of the service virtual enterprise

Based upon the type of communication between one-of-a-kind producer or service partner and customer the services of a one-of-a-kind producer can be grouped in four categories [5].

- **General Support** consists of services that involve the use of basic means of communication, such as language, mail, fax, chat, and so on.
- **Self Support** utilizes aids and information that a one-of-a-kind producer, or service partner, makes available without playing an active role in their use. No person-to-person interaction takes place between the one-of-a-kind producer, or service partner, and the customer.
- **Remote Support** is ICT-supported interaction between one-of-a-kind producer, service partner, and customer that requires the exchange of images or machine data. This can take place with audiovisual aids.
- **On Site Support** requires that an employee of the one-of-a-kind producer or service partner is present at the customer's plant.

In addition, it is possible to utilize the scheme for all sales phases through the entire sales life-cycle. The service model reveals that many services can also be utilized in the sales or pre-sales phase. Very often customers are not interested in specific services because they expect problem solutions. This can be taken into account by service products. As a rule, service product is understood here as a combination of individual services. This

service product, or combination of services, is provided to or offered for sale to the customer by the one-of-a-kind producer or service partner. For example the shaded services in the service portfolio (figure 3) represent a service product that might consist of spare part management, remote consulting, remote diagnostics, repair and optimisation. This service product is applied in scenario (see section 5).

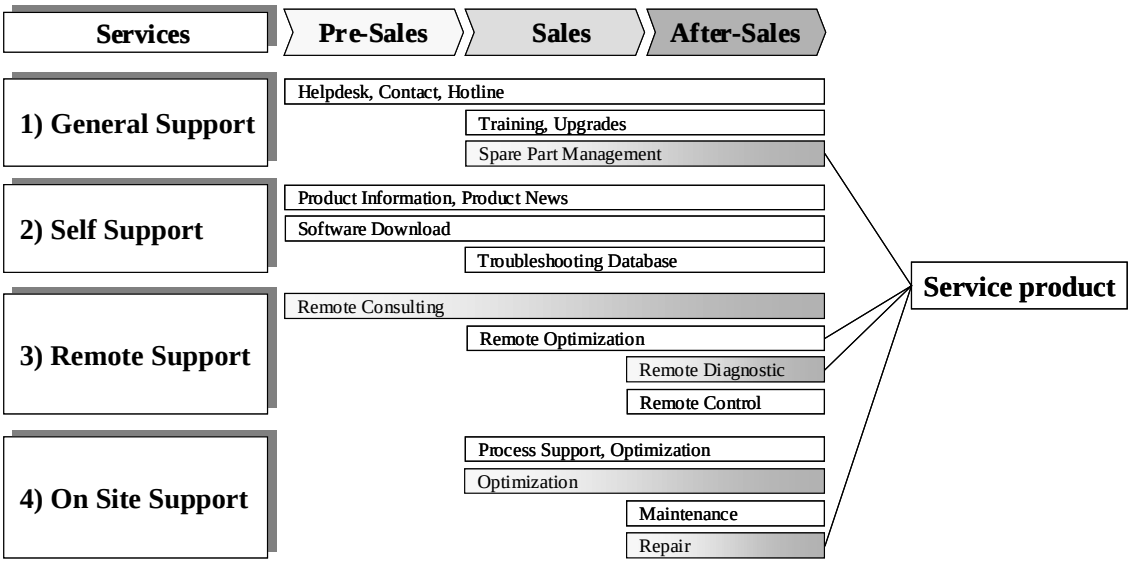


*Figure 3: Service portfolio of a one-of-a-kind producer or a service virtual enterprise*

The service portfolio represents the service spectrum of a company or a service virtual enterprise.

# 4. E-Service Support System

Managing worldwide services in a service network requires that the involved parties are supported with proper services and applications. This is very important in all phases of the service process especially in the service fulfilment phase where different users with different skills have to deal with complex machine- and plant equipment and complicate information exchange is required by all participants (compare figure 2). In this phase there are also some critical information that are only directed to selected users.

In a service virtual enterprise at least four different main user groups (roles) that are directly involved in fulfilling specific service tasks have to be handled by an information system:

- Service Centre Staff: These persons can be an after-sales manager, product specialists, after-sales administration personnel or persons from the sales.
- Service Technicians: Service technicians are spread worldwide and solve customer problems on customer site.

- Customers: At customer side the mainly involved persons are the plant operators, engineers or maintenance personnel.
- Service Partners: Service partners can be spare-part suppliers but also service technicians that perform specific service tasks for the one-of-a-kind producer.

Depending on the required service or application communication can take place from user to user, user to machine or machine to machine. The three channels for information exchange of the E-Service Support System are shown in figure 4.

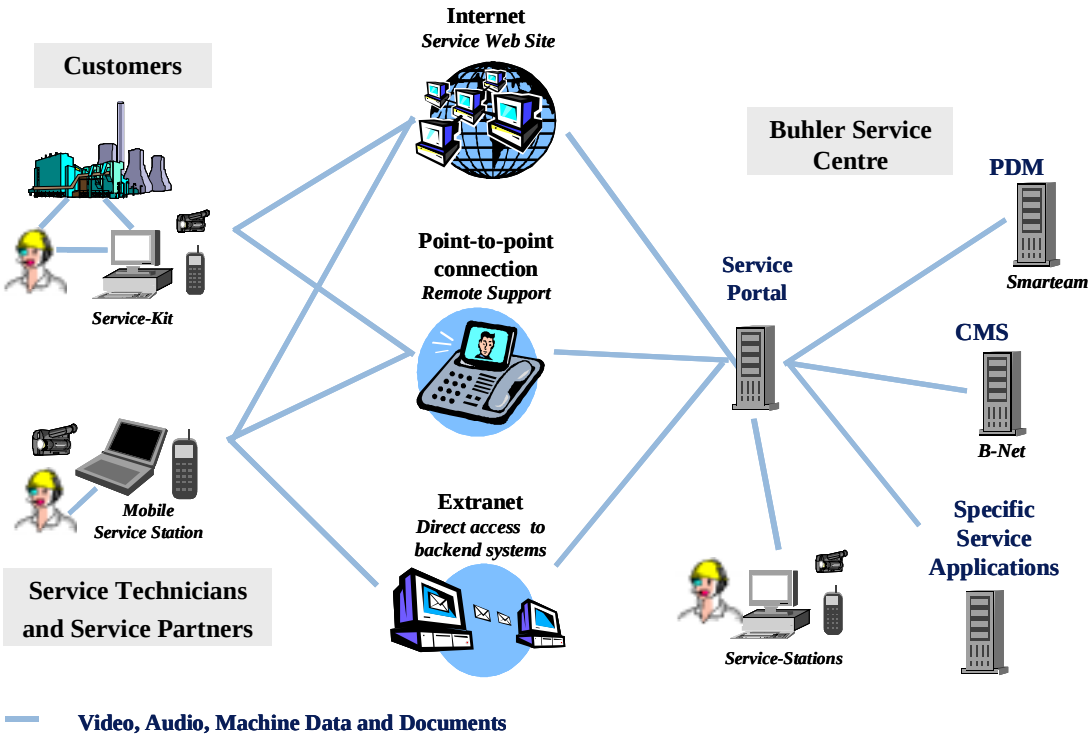


*Figure 4: Concept of the E-Service Support System*

The three communication channels of the E-Service Support System are an Internet Channel, a Point-to-Point Channel and an Extranet-Channel. These communication channels allow the different users to establish interactive communication with other parts in the SVE and to access service information according to their specific needs and to the required service mission. The relations between the information channels, the users and the related services are shown in figure 5.

| Channel | Type of channel | Main users | Services |
|---|---|---|---|
|  | **Internet: Service Web-Site with**<br>• Public area<br>• Common area *(Password required)*<br>• Customer area *(Service contract required)* | • Customers<br>• Service Centre Staff<br>• Service Technicians | FAQ,<br>Product information<br>Downloads<br>Documentation<br>Remote Diagnostic |
|  | **Point-to-Point connection:**<br>• Telephone<br>• Videoconference<br>• Application sharing<br>• Exchange of data via FTP (pictures, videos, drawings, machine data...) | • Customers<br>• Service Centre Staff<br>• Service Technicians<br>• Service partners | Remote<br>Consulting and<br>Diagnostic |
|  | **Extranet:**<br>• Secure connection to Buhler Backend Systems *(e.g. PDM, B-Net,)* | • Service Centre Staff<br>• Buhler Service Technicians | Access to expert database<br>Buhler forum<br>Buhler yellow pages |

*Figure 5: Communication channels of the E-Service Support System*

At Buhler side persons at the Service Centre are equipped with so called “Service Stations” that include personal computers, web-cams for video conferencing, phones etc. A connection to different data sources like a product management system (PDM), content management system (CMS), service specific application like remote monitoring software and access to the internet are established over a central server [6]. Service technicians are equipped with mobile computing hardware (e.g. laptops, digital video cameras, hand-held, etc.) being able to communicate with others independent of their current location. At customers side a so called “service kit” is installed to make communication to other parties possible. In the future also mobile computing equipment like e.g. wearable computers might be used in order to cooperate interactively with Buhler experts during a service mission.

# 5. Scenarios

The following scenario outlines the execution of the after-sales service process (cf. figure 2) in a service network and the use of the E-Service Support System triggered by a customer request. Figure 6 illustrates the overall situation.

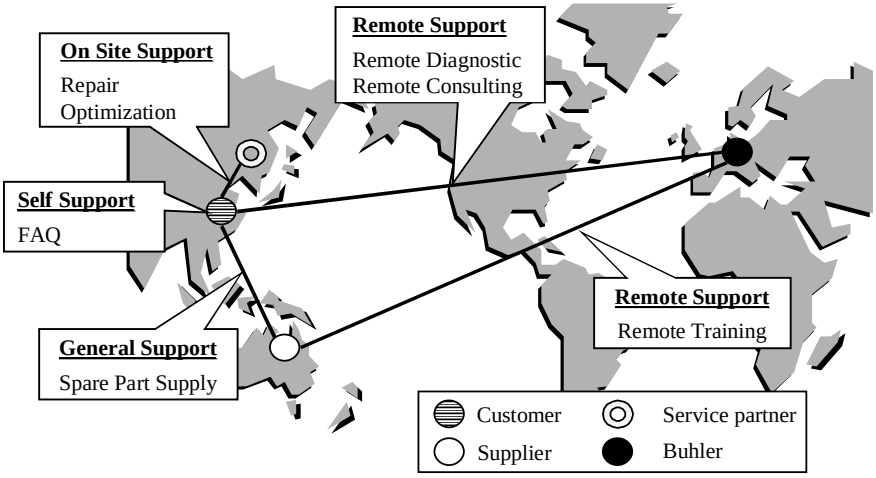


*Figure 6: Distributed collaborative after-sales service*

In the Buhler case service execution is based on the generic service virtual enterprise process described in section 2.1. The entire service process and the related services (service product) are illustrated in figure 7.

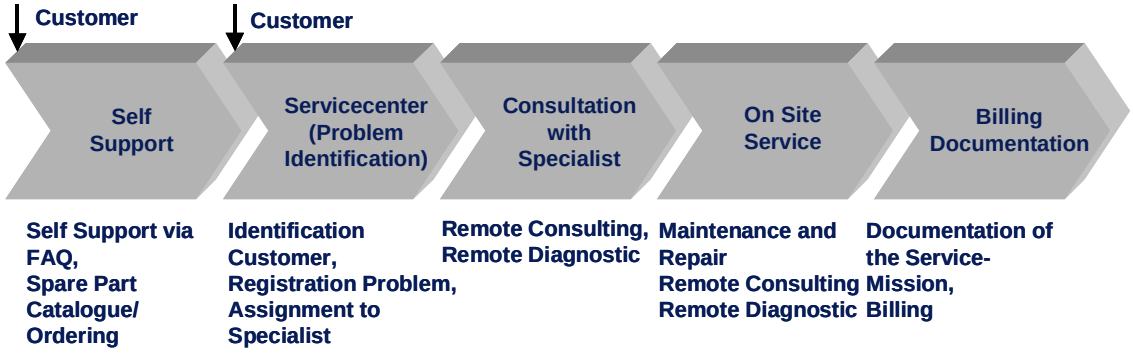


*Figure 7: Buhler specific service virtual enterprise process*

The SVE-process is triggered if a problem on a customer plant occurs and the customer is accessing the service support system or directly by contacting the world-wide service centre.

**Scenario:** A customer in Asia is experiencing reduced output on his feed processing plant. The cause of the failure is not known. Because some years ago the customer has signed a service contract with Buhler he has access to specific service products. The service products may e.g. include access to FAQ, online diagnostics and remote monitoring service and 20 hours free online consulting.

In a first step the customer accesses the service portal (figure 8).

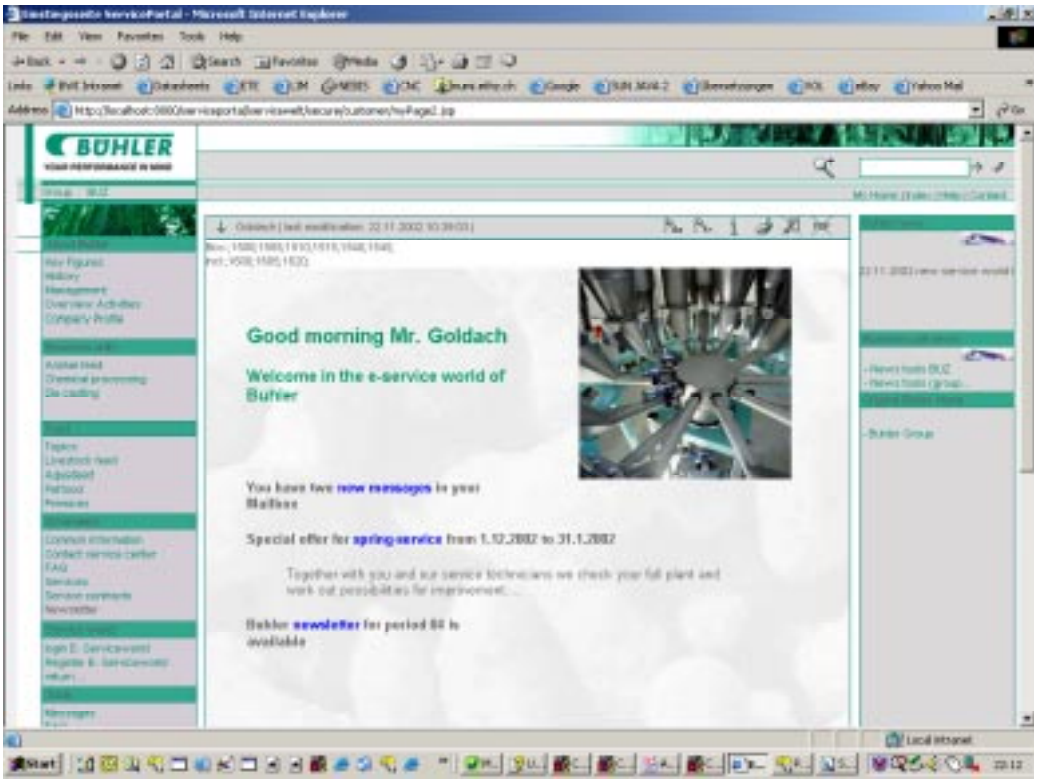


*Figure 8: Example of login screen*

After logging in to his personalized web-page the customer searches in the specific FAQ database for similar problems that may have occurred in the past (*Self Support*). As the customer does not receive an appropriate hit, the customer calls the service centre. The service manager at the service centre performs a remote login (point-to-point connection) to the plant control system of the customer *(Remote Diagnosti*c). With the help of the process status visualization tool the plant conditions are inspected. The process visualization system shows that there is a problem with the pellet mill. During the remote diagnosis the service manager stays in contact with the customer and gives advice on how to change the process parameters of the pellet mill. The change of the production output is tracked by both the customer and the service manager. It becomes apparent that the problem is caused by the press rolls of the pellet mill. Unfortunately the customer can't perform the required service by himself. The service manager looks for available Buhler service personnel. In the required time period there is no expert available but a proper service partner with a skilled service technician can be identified and a service request for a service mission is delegated to the partner company. At the same time a temporary service account especially for this service case is created in the PDM-system SmarTeam®. The account covers all service related information in a secure environment and is only available to the users currently involved in this specific service mission. The history of the current service case is documented and during the journey to the customer the hired service technician can survey the service activities that have already been performed on the regarding plant and the pellet mill.


*Figure 9: Utilities for remote consulting (service kit)*

As the hired service technician is not an expert in the service of pellet mills he accesses the multimedia online repair manual in the PDM-system through the internet and performs the disassembling of the pellet mill as described in the manual.

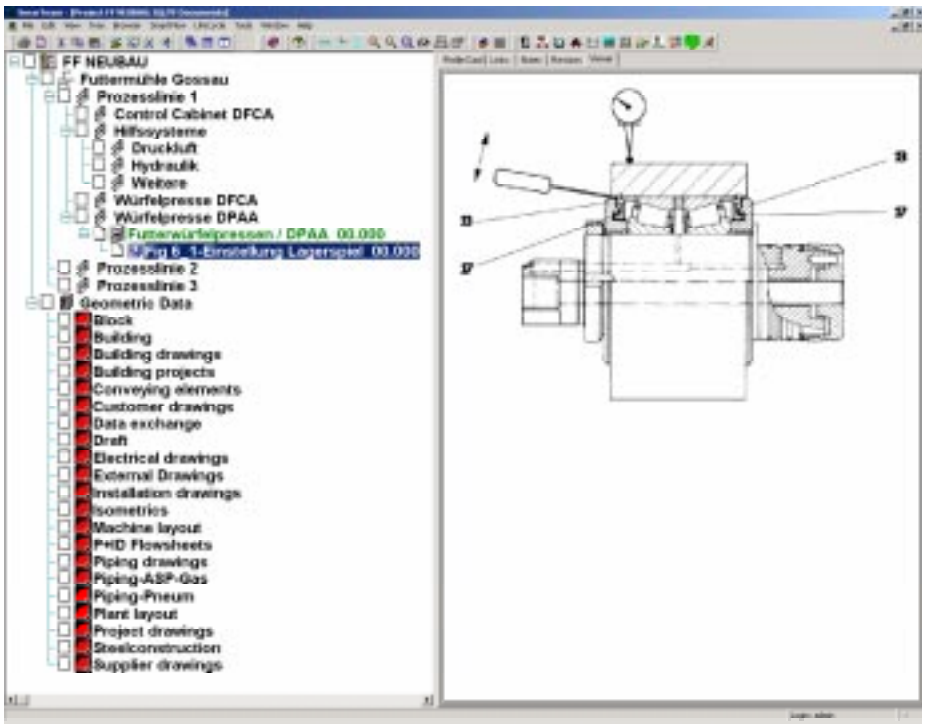


*Figure 10: Repair step for setup of the slackness of the main bearing of the press roll*

The service technician is supported by remote consulting from the service centre. Based on the remote diagnostic data the service manager in the service centre detected also that the machine settings had not been chosen optimally. The service manager explains to the service technician how to optimize the machine settings after completing the repair task. From now on the plant is running as expected. In the last process step the service account is closed and the service case is stored in the PDM-System SmarTeam©. An invoice is made according to the service contract held by the customer and sent to the customer.

This scenario shows that the customer's demands (rapid repair of the machine failure at a reasonable cost) require a tight setup and coordination of all parties involved in the SVE. In the common endeavour, each selected partner in the network contributes its skills, core competencies, or capacities. The one-of-a-kind producer alone would not be in a position to resolve the problem in a comparable period of time.

# 6. Conclusion

The advancing development of new information and communication technologies has created the basis for virtual presence at any time, any place worldwide. Continual development of these technologies also opens up new possibilities for the one-of-a kind industry with regard to design and delivery of services. The article describes the utilisation of the service virtual enterprise concept that has been elaborated in the GLOBEMEN project. The E-Service Support System illustrates how the different already available technologies and applications can be combined to support a distributed after-sales service process dependent on the different needs of the parties involved in the service. However, there are still a lot of technical challenges in the support of a world-wide service organisation. Service data and knowledge are bound to individual companies with their own specific information systems and technologies. But success also does not only depend on technical perfection and availability. The same service products require that the generic after-sales service process will be aligned to individual customer wishes, cultures and problems. The existing mentality of all service partners and service strategies must also be revised and redesigned. One today’s slogan is “a global service organization for local needs”.

# 7. Abbreviations

| | |
|---|---|
| B-NET | Buhler Intranet |
| CMS | Content Management System |
| E3S | E-Service Support System |
| FAQ | Frequently Asked Questions |
| FTP | File Transfer Protocol |

| | |
|---|---|
| GERAM | Generalized Enterprise Reference Architecture and Methodology |
| ICT | Information and Communication Technologies |
| PDM | Product Data Management |
| SmarTeam® | PDM-software provider |
| SVE | Service Virtual Enterprise |

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