Life cycle services for SIMATIC PCS 7

SIEMENS

White paper

In addition to the initial investment, plant operators have, in the past years, increasingly concentrated on the costs incurred in the operation phase of process plants. These costs often form the basis on which suppliers are selected. Which service concepts can contribute to the maintenance of both plant value and plant efficiency during the whole plant life cycle?

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Investment protection and system availability are considered success factors for control and automation technology in typical process plants of the chemical industry. Today, services which ensure the service capability of installed systems, are laid down from the very beginning in a contract between the plant operator and the supplier. The purpose of these so-called life cycle services is to maintain the existing functions of instrumentation and control systems at minimum expense over a defined period of time. Corresponding contracts specify upgrading and migration cycles, as well as the availability of spare parts for a particular term in advance. This makes reliable long-term planning possible.

Contents

Principles and challenges

In some industries the average life cycle of a process engineering plant is typically 20 years. Each phase challenges the plant operator in its own typical way, requiring special knowledge and associated costs. Diverse tasks that arise from the first concept, through planning and construction and on to operation and modernization, are covered by the supplier with appropriate services, i.e. feasibility studies, project management, engineering, optimization, energy consulting, spare parts supply etc. This white paper concentrates first and foremost on the services which are most important for the availability and service capability (the so-called life cycle services) of control engineering and automation technology for plant operators. In principle, service performances should contribute towards keeping the existing functions working and the process plant in reliable operation. They ensure that plant value and plant efficiency are maintained over the whole service life cycle. Furthermore, they open up the possibility for the user to realize new innovative functions via upgrading.

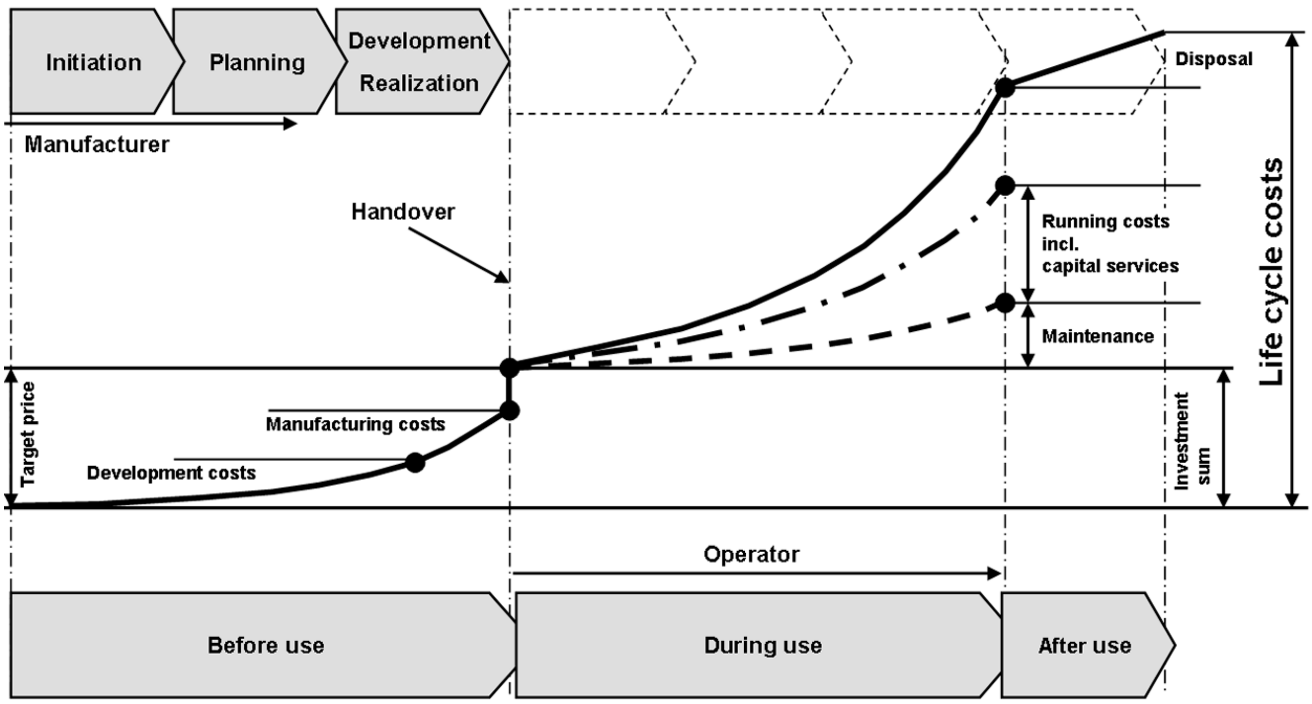
This white paper concentrates on services which ensure the availability and service capability (the so-called life cycle services) of control technology and automation technology.

Total cost of ownership

When the overall life cycle costs are considered, the concentration is not only on the purchase costs but also on development, operating and other costs. The two terms that are frequently synonymously used in literature for these costs are: Life cycle costs (LCC) and total cost of ownership (TCO). Both are defined as being tools of strategy oriented cost management.[1]

Life cycle costs (LCC) and total cost of ownership (TCO) are seen as tools of a strategy oriented cost management.

[1] Refer here, for example, to:
Stefan Schweiger (editor): Lebenszykluskosten optimieren: Paradigmenwechsel für Anbieter und Nutzer von Investitionsgütern, Wiesbaden 2009. p. 38f.
Klaus Geißdörfer: Total cost of ownership (TCO) und life cycle costing (LCC) : Einsatz und Modelle: ein Vergleich zwischen Deutschland und USA, Berlin 2009.



Schematic presentation of life cycle costs[2]

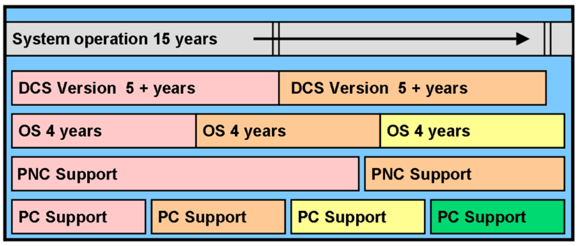
Costs, (e.g. for human resources and goods used and also the expenses for maintenance or energy used that accrue after set-up), are correspondingly higher for operating times covering several decades than they were in the original investment. Therefore the optimization of the operating costs is of prime importance for the plant operators. As the significance of subsequent costs is greater than for initial investments, more and more decisions concerning the construction of a new plant or a plant extension are made on the basis of a detailed running cost analysis. Greater concentration is therefore on life cycle services of the operating phase prior to the investment decision. The installed distributed control system exerts a substantial leverage on the economy. System providers are therefore increasingly committed to provide an appropriate service over the predefined time period and in particular, to present it transparently with regard to the extent of performance and costs. After all, the annual maintenance costs of a management system sum up to about nine percent of the purchasing cost of a control system solution.[3] This expenditure is not only to protect the investment for the technology supplied but, to a greater extent, to maintain the function of the control system over a defined time period at a minimized cost. However, contrary to the past, this can now only be economically ensured by planned modernization measures.

This can be attributed to IT systems widely implemented in automation. Increased operator comfort, greater functionality and higher productivity have their price: IT systems such as, for example, PC systems, are subject to a high rate of ongoing development. According to the law of averages applied by Gordon Moore, the complexity of integrated circuits doubles every one or two years[4]. This not only affects hardware components but also operating systems and user software: An average service life of five years is expected for components of a management system which is far from the process. This is conditional on the spare parts availability and software support on the part of the manufacturer. The operating system versions that are used are also subject to innovation cycles of three to five years and the manufacturer only supports them with security updates and software for a certain time.

Decisions on a new construction or rather an extension project are taken on the basis of a detailed running costs analysis, i.e. life cycle services must be thoroughly examined prior to an investment decision.

[2] cf. VDI 2884, Issue 2005:12
[3] cf. ARC-Study "Process Automation Maintenance Costs Survey", 2004.

[4] Gordon E. Moore: Cramming more components onto integrated circuits. In: Electronics 19, no.3 (1965), pp. 114-117.



Example of typical replacement intervals for key process components during the operating time[5]

These innovation cycles make constant adaption necessary, these give rise to many questions for the plant operator: Which modernization is necessary at which point in time? Must we go along with every leap in technology? Which measures are appropriate, which are superfluous?

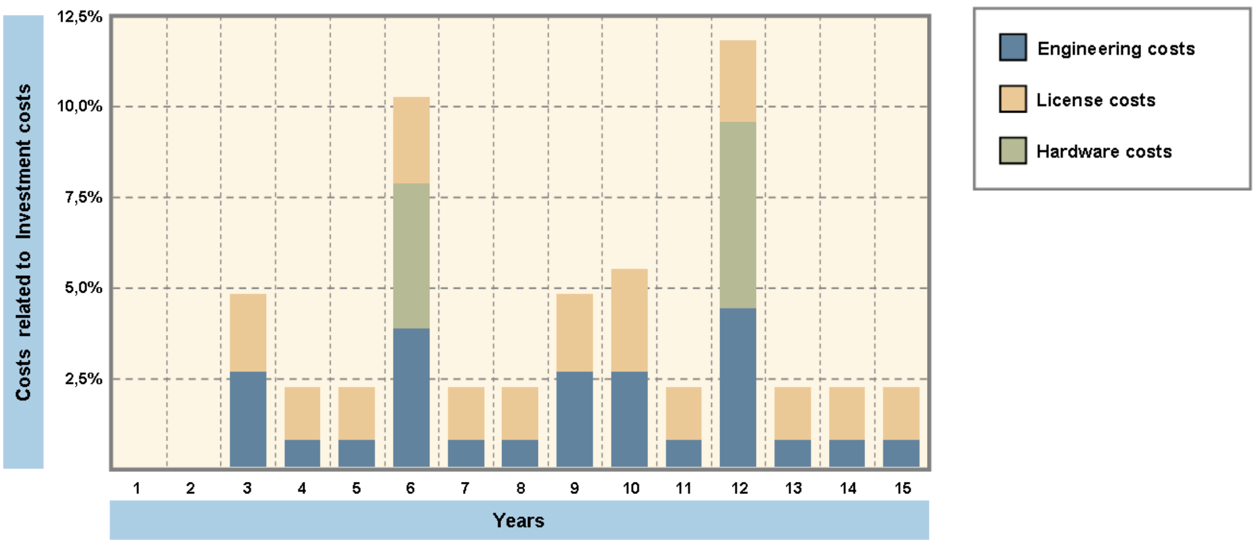
Where formerly costs for

- own maintenance personnel or external service providers,
- production downtimes resulting from defects and the corresponding repair expenditure and
- the stocking of spare parts

were considered, plant operators are now confronted with a whole series of additional expenses[6]:

- running maintenance expenses (maintenance and inspections, updates, security-patches)
- maintenance agreements (services for IT-systems, PCs etc.)
- Costs for upgrading or migrations, engineering costs and repair costs, hardware replacement costs, license fees for systems software
- Training costs

Only a professional concept and long-term, customized service contracts offer cost transparency and permanent protection of investment. Examinations have shown that the development of the costs for the procurement and maintenance of distributed control systems has appreciably decreased.[7]



Example of the course of life cycle costs acc. to Albert[7]

[5] Thomas Hauff: Qualitätssicherung leittechnischer Systeme. In: atp 1-2 (2009), p. 77.

[6] See NE 121: Qualitätssicherung leittechnischer Systeme, Version 15.09.2008, p. 10 f.

[7] Wolfgang Albert: Total Cost of Ownership bei Prozessleitsystemen. In: atp edition 1-2 (2010), pp. 24-30.

Standards and guidelines

For many years, international committees have been dealing with questions that apply to product and plant life cycles as well as to the corresponding service performances and their importance for process engineering plants. The following is a selection of some of the publications that have resulted from their work.

DIN EN 62402: Guidance on obsolescence management

Predictable, actually occurring or assumed obsolescence, i.e. due to artificial or natural product ageing, results in a limitation of the usage or a complete failure of technical systems. These partly lead to considerable unbudgeted costs. The increasing use of commercially available components in complex products for which a high service life is expected, has made obsolescence management essential. Suitable procedures and measures can allow the results of obsolescence to be avoided or delayed, or their consequences to be mitigated. These include possible solutions brought about by the manufacturer such as timely information sent to the customers (opportunity for a last time buy), the development of maintenance and spare parts procurement concepts and jointly working substitution solutions. Appropriate measures that the customer could bring are, for example, systematic recording and analysis of the procurement market in the run up, notice analyses and a timely build-up of a spare parts stock for the rest of the planned utilization time.
DKE/K 132 German Commission for Electrical, Electronic and Information Technology of DIN and VDE (DKE) published the first standard on obsolescence management, DIN EN 62402, in 2008: This is intended to provide guidance on the fixing of a suitable framework and the planning of a cost-effective obsolescence management process for all phases of the product life cycle. The term product covers assets, infrastructure, durable consumer goods, expendable items and software products.

The increasing use of commercially available components in complex products makes obsolescence management essential.

NAMUR Recommendation NE 121

The NAMUR working group 2.11 “Industrial IT/ Process Control Technology” deals with special requirements and problems which arise from the linkage of highly dynamic information technology to cost-intensive and long-life control technology. The committee has worked out a methodology for the technical and economical optimization of the procurement and operation of industrial control technology, i.e. of automation technology based on actual IT platforms under particular consideration of the follow-up costs, which is the subject of NAMUR recommendation NE 121. Long-term protection of investment, life cycle costs and safeguarding against downtime costs are at the centre of attention and are defined as being specific demands on the control system. They are specified in the operational specifications book and are thus systematically considered, both in the selection of a system and when upgrades or extensions are planned. Particular attention is given to industrial control technology quality assurance and obsolescence management over the whole life cycle.

NAMUR NE 121 concentrates on long-term protection of investment, life cycle costs and safeguards against downtime costs. These aspects are defined as being specific demands on the control system.

ZVEI Initiative "Services in Automation"

“Services in Automation” is the name of an initiative that the German automation trade association (part of ZVEI) introduced in 2004. The participating member companies reacted to the increasing need of services in the automation area. In this initiative, services were subjected to structuring, description and classification (product-related, application-specific, system- and plant-related services, categorized in seven complexity classes). A common basis for understanding between suppliers and customers, and therefore also a basis for corresponding agreements was developed. A commitments charter for the supplier is assigned to each of the service classes.
The use of the class structure not only makes it possible to easily identify the services offered. It also simplifies establishing desired results and performance data together with the customer.
Upon registration the companies which participate in the initiative acquire a protected service logo which symbolizes quality assurance and conformity to regulations. Services required can be modularly selected from the seven service classes and offered appropriately.

Service spectrum

In addition to high-quality products, plant operators treasure excellent customer service and worldwide technical support. Professional after-sales service contributes greatly towards increasing productivity and reliability and is today, indispensable. System manufacturers have recognized that offering coordinated service is a distinguishing feature in the market. Services can be more quickly and flexibly provided than physical products, cannot be so easily copied and result in long-term customer satisfaction. Which services are beneficial for the customer is examined more closely in the following.

Professional after-sales service contributes greatly towards increasing productivity and reliability and is indispensable in this day and age.

Design for the life cycle

The basis for service performances and, above all for the serviceability of plants, is presently already set in the first projecting phase of new planning and constructions: For example, the maintenance of established engineering standards ensures that the software can be upgraded even in the future. Further to this, the hardware to be used is only to be obtained from suppliers who can show a reliable concept for the life cycle support of the hardware components.

Integrated life cycle engineering based on life cycle asset information management systems such as Comos, enables plant planners, constructors and plant operators to apply worldwide standardization to their engineering and maintenance processes and to implement a platform for the strategic and universal administration of planning data and active assets.

The basis for the service performances and service ability is already set in the first drawing up of new planning and constructions.

DCS Evaluation

With plants that are already constructed, it is necessary to make an extensive examination of the installed systems of various manufactures with regard, to their condition, service capability, compatibility etc. NE 121 names the technical systems evaluation of the DCS as being an important aspect with regard to quality assurance, together with quality aspects and defined life cycle concepts. This system judgment is typically carried out as an audit / assessment. Due to its complexity it is not carried out by the user, but by an external service provider / supplier.
The maintenance of engineering standards, IT security and stipulations of system suppliers, are just as much part of the testing process as the individual system components. The target is to determine the service capability and upgrading ability and to derive consequential measures.

Service contract management and obsolescence management

Plant-specific on-location inventory of the hardware and software used is necessary for an optimally matched life cycle service concept and corresponding contracts. A plant data base makes the introduction of obsolescence management possible. The service capability and availability requirements of the hardware and software used can only be derived from actual plant data.
As process engineering plants are frequently subjected to changes, service contracts are subject to certain dynamics. Therefore service contract management includes the planning of measures and of performance controlling in addition to the actual documentation and handling of the contract.

Product service and support

One of the basic service performances in after-sales business is the product service that supports the customer should questions or problems arise. With process engineering plants, a product service that is always available in case of an emergency, is an effective insurance that plant downtimes can be shortened or even prevented. Plant operators should be able to select various technical support steps according to their requirements and thus to be given quick and uncomplicated individual support specific for their plants. Escalation mechanisms ensure optimized reaction times and allow the handling of complex inquiries. Plant operators should also have additional troubleshooting possibilities available alongside such hotline services. Web-based online support is an efficient pathway to self-help without time delay: Manuals, operating instructions and general product information literature, form a central information pool that jointly with product-oriented search functions, brings you to your target in only a few steps. FAQs provide answers to frequently asked product-related questions, experts give users concrete support in forums and via short information videos, so-called Webcasts, which enable even complex facts to be conveyed. Regularly published Newsletters keep customers up to date, as do subscripted RSS-Newsfeeds. What's important here are an appropriate preparation and proper and correct contents, as well as intuitively and rapidly finding the required information.

Maintenance and maintenance strategy

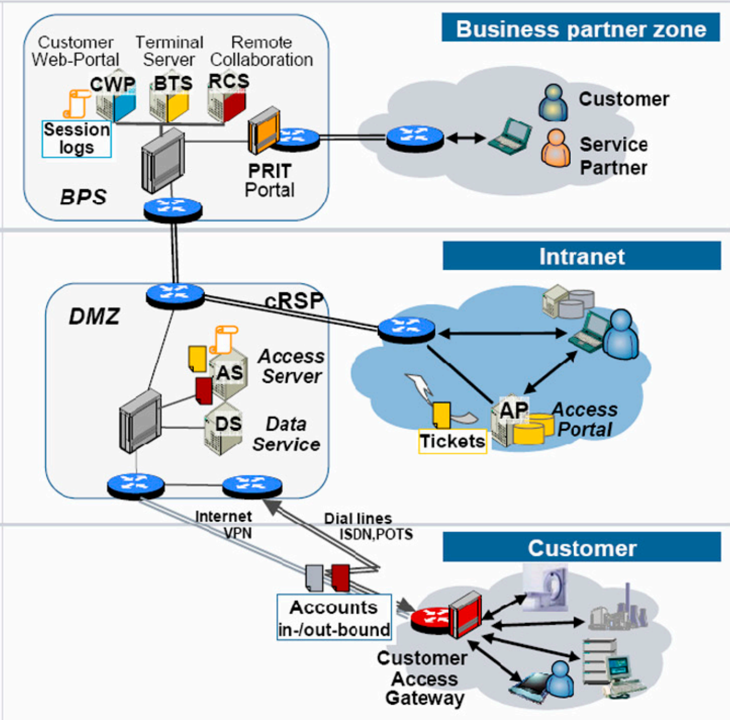
Even with high quality production, mature design and professional installation, the greatest possible system availability can only be attained when the plant is appropriately operated and maintained according to regulations. Flexible preventive maintenance measures have extensively replaced the classical on-site inspections according to rigid maintenance schedules. Critical process components are examined at certain intervals according to fixed maintenance schedules, or even replaced when necessary. These preventive, time-based measures avoid expensive downtimes. In the meantime, far more cost-favorable alternatives have become established which complement condition-based maintenance concepts. Maintenance requirements are directly determined via the actual condition of individual components. For example, an evaluation of switching cycles or operating time counters allows conclusions to be drawn on the actual load factor and wear of the individual components. The remaining failure-free operating time can then be determined with the appropriate high level of probability.
Depending on the personnel situation and the importance and size of the plant, customers can fall back on the regional / central on-call service of the service provider. With specified call, response and service times, this guarantee competent and appropriate on-site services.

Remote support

Remote technology now provides a further, comfortable possibility for carrying out inspections: System resources can be checked over secure online access in the same way as system and user software processes. The evaluation of system records allows conclusions to be drawn on the condition of the plant. Remote service is, in many cases, a suitable means of solving problems: Specialists can quickly and flexibly access the plant concerned and provide maintenance personnel with targeted support.
IT Security is of great importance in any form of online access. The abidance to international security standards must be ensured. Techniques for safeguarding the communication paths, such as VPN or IPsec, authentication mechanisms, as well as audit Remote support-trail, logging and reporting, are prerequisites for this type of access. When these are fulfilled, then service performances such as inspection, maintenance and repair of many components can be dealt with efficiently. Inspection reports, also on online maintenance, ensure transparency of the completed measures and can also provide valuable clues to optimization that should be completed. When corresponding condition monitoring systems are installed, these reports are stored in the system with the plant performance documentation.

Remote Service is in many cases the suitable means of providing help from afar: Specialists can quickly and flexibly access the actual plant and provide care personnel with targeted support.

Business partner zone	▪ **Customer Web Portal (CWP):** Supports the access to Monitoring and Reporting. ▪ **Terminal Server (BTS):** Facilitates the access from external service partners to chosen systems. ▪ **Remote Collaboration (RCS):** Facilitates the collaboration of external and internal technicians in a meeting.
Authorization of users and systems incl. communication	▪ **Access Portal (AP):** Data base and portal support the authorization of the user and systems. ▪ **Access Server (AS):** Transfers the authorized communication to the systems incl. Logging and Monitoring. ▪ **Data Service (DS):** The data service receives the data and forwards them to other services
Secure customer gateway	▪ **Customer Access Gateway (CAG):** Depending on the corresponding requirement, additional applications for authentication, logging und monitoring can be used.



Reliable real-time data connections between the IT system landscape of the customer and the service technician enable system faults to be discovered at an early stage and to be remedied without the help of an on-site service technician.

Spare parts and repairs

Functioning spare part logistics are a must to reduce downtimes caused by component failures. The spare parts could be available in a central store, in a regional store, available at the location or accessible for a network of plants in a consignment store – there are numerous options. They should be individually selected according to the importance of the individual components for trouble-free plant operation. Plant operators should in each case fall back on original spare parts. In this respect an implemented product life cycle management of the supplier is indispensible: Customers must be reliably supplied with spare parts.
Repair is often possible, and repair times can be bridged when necessary, with reconditioned equipment. Many manufacturers offer a price concession when defective parts are returned. If repairs can only be made on-site, it pays off for the customer when the system provider has a worldwide presence – the shorter the distance, the quicker the service.

Modernization and upgrades

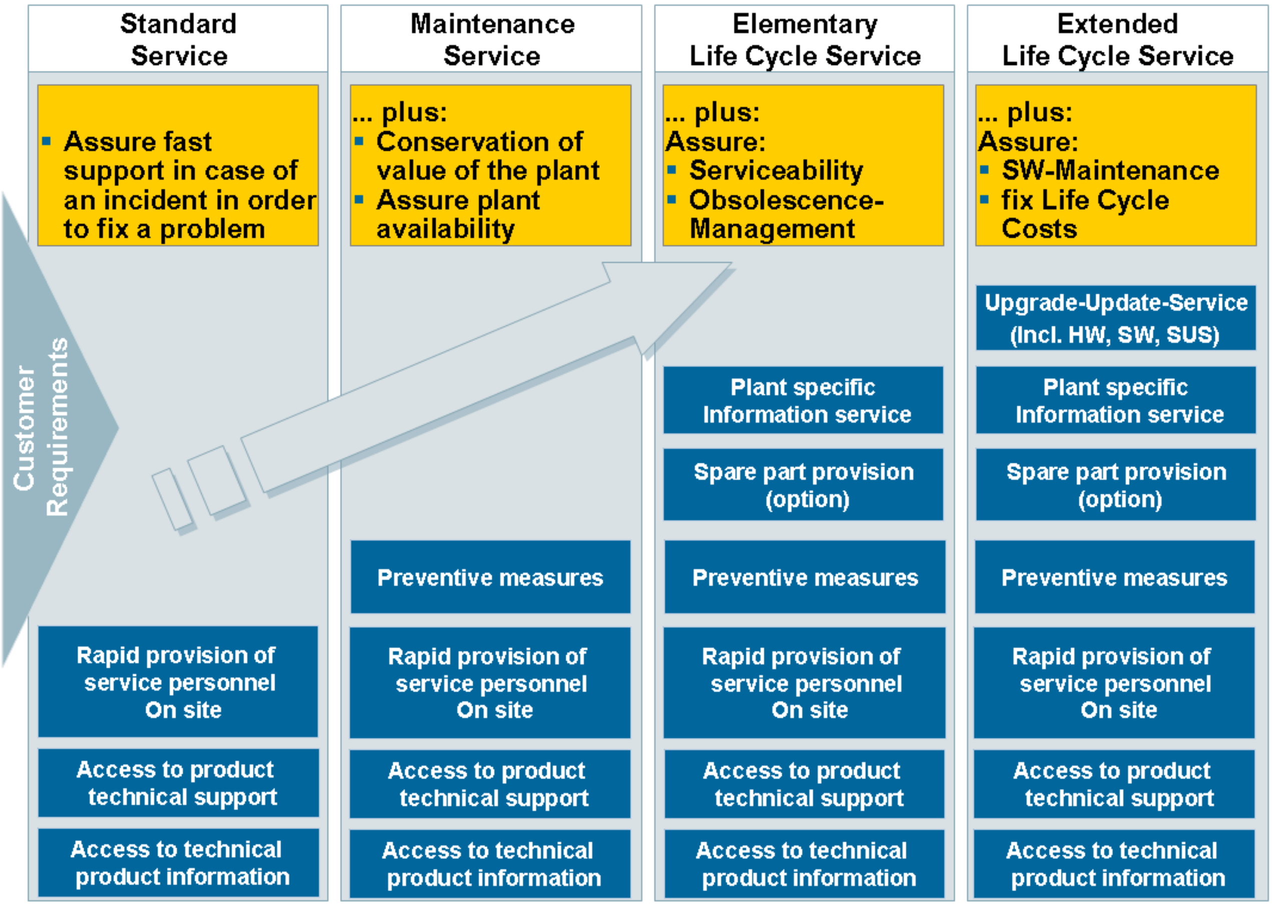
The increased pressure for innovation using PC systems in process control technology that was described in Chapter 1, has also changed the meaning of the term modernization: Hardware and software modernization is always a mutual process. Operating systems, distributed control systems and user software cannot be kept for any length of time at a static hardware level. Dependency relationships, required resources, specifications and system compatibilities, make a cleverly designed modernizing or migration management necessary. Upgrading or migration steps must be determined in time, because system components must, at times, be replaced several times in the course of a plant life cycle. As process-oriented components still have long service lives, it must be ensured that these are compatible with the system software version of the (upgraded) remote process components of the management system. To avoid unplanned operating downtimes, it is very important that the application software, which represents a considerable value for the plant operator, can be used without any problems after any migration steps. The course for this can be set as early as in the control engineering project planning phase, with application software created on the basis of engineering standards and by the use of standardized communication records.
For long-term service contracts, both hardware and software must always be in a serviceable condition. Measures that are carried out must be documented centrally. Obsolescence management can only function when the plant database is kept updated.

Additionally, service oriented system suppliers ensure a well-directed flow of information to the customer. Plant specific updating information, together with recommendations and news on product life cycle management enable the user to take modernizing decisions from a firm base. The management system software upgrades which the plant operator receives, could include provision for a corresponding functionality extension for increased productivity after the change. By means of the exact list of all assemblies in the service contract, the hardware components requiring replacement to utilize new functions, can be established in advance. The utilization of new control technology features is not always ensured with older generations and versions. In part, assemblies can also be updated to allow the required increase in function.

Service contracts

No two process engineering plants are alike. This is why each service contract is also unique and adapted to the needs of each particular customer. A selection of individual service modules, each with specified performances, simplifies the compilation of such contracts. Priority is given either to long term security or an increase in plant productivity; the costs for the latter are transparent and can be included in the budget. Some standard types of service contract can be identified by recurring customer performance profiles.

The selection of individual service modules, each with a defined scope of performance, simplifies the compilation of service contracts. Foremost hereby is always either long-term security or increased plant productivity at a cost which is transparent and can be planned.



Typical requirement scenarios for service performances

Standard service

Such a contract should ensure rapid technical support. Service and support can be provided online, by telephone or on-site by a service technician. The service and response times must be agreed upon to meet the demand in question. When remote maintenance is possible and requested, this must also be regulated by an agreement: Who is given the right to access which part of the plant and where are interventions recorded etc.

Maintenance service

This agreement comprises performances that are to contribute to the value-maintenance of the plant in addition to the performances of a simple support contract. It usually contains measures for preventive maintenance. In addition, service level agreements can also be made which allow the key performance indicators (KPI) to be measured and established. Long-term inspection and maintenance contracts ensure a reduction of unplanned downtimes as well as optimized maintenance of the value of the plant and plant components.

Elementary life cycle service

If the plant is always to be in a serviceable condition, the extent of the services is correspondingly extended by the addition of obsolescence management. This begins with the provision of actual and plant specific information on the availability of technical components for obsolescence management at the customer's site. It can reach as far as the complete planning and handling of a modernization by the system supplier. It always pays off for the plant operator to request a system provider who produces as many components as possible themselves and not to buy them in. Only in such a way can the planning and execution of product obsolescence be completely integrated in the product life cycle management of the manufacturer and the remaining risk of non-availability of individual components minimized. The corresponding spare parts logistics concept can supplement such a service contract. Stocking strategies that are coupled to the obsolescence management, allow the reliable availability of components within fixed parameter and modernizing plans. Worldwide located suppliers can support the user from regionally autonomous spare part stocks and with on-site service and short delivery times. Stocking costs are thus reduced drastically without risking long downtimes.

Extended life cycle service

An extensive life cycle service package can be realized for the user by supplementing the service packages named by an upgrade version. This comprises a recording of all agreed-upon and appropriate upgrades on hardware and software. The concentration of these long-term contracts is on the functional maintenance of the whole system and the full details on the planning ability of the TCO. For example, with the conclusion of such an extended life cycle service contract, the customer fixes the life cycle costs of the distributed control system that will arise for him over the next 15 years. They can simultaneously extensively ensure that the plant will fulfill the required functions over the time period fixed by means of reconstruction times that are agreed upon with the supplier.

Extensive cost transparency: With the signing of an extended life cycle service contract, the life cycle costs associated with process control technology over, for example, the next 15 years, are fixed.

Conclusions and outlook

The need for services for automated plants over their whole life cycle will continue to increase. This is understandable, as the customer benefits that are given on the use of appropriate service packages speak for themselves:

- Increased plant availability
- Planned optimized life cycle costs
- Protection of investment and a serviceable condition
- Concentration on the core business by outsourcing certain tasks, e.g. control technology maintenance
- No build-up of own personnel know-how necessary despite a continuous increase in the complexity of the technology
- Risk minimization because of the additional specialists provided by the system provider

To make full use of these benefits, a modular and individually adaptable service portfolio is required, as well as a competent and reliable partner. Suppliers who have their own extensive product portfolio, and so are less dependent on the buying-in of components, master the life cycle challenges. Further to this, those manufacturers are to be preferred who, in the development of their products, maintain and use stable norms and standards and also ensure a high degree of compatibility. Well thought-out follow-up concepts (life time extension concepts) after component termination, belong to the requirements that the manufacturer should fulfill. Suppliers who are internationally represented and offer such service packages are well prepared to act as life cycle partners.
Considered over and beyond the whole life cycle, service models are at present only in the beginning phase. In future similar contracting models as found for power, energy and compressed air could also be negotiated for process automation: Fixed prices are agreed upon for automated functions. The control technology supplier will develop to become a function provider who, with the help of his own plant and automation technology, fulfils certain automation tasks. These performances could be correspondingly “value-based” or “performance-based”, i.e. be calculated according to the performance value. Customers will gain value or performance benefits from their utilizing service performances. Savings, increases in efficiency or higher performances will be fixed and payment made depending on the performance. Then customer is always on the safe side!

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List of abbreviations

BTS	Business Terminal Server
cRSP	Common Remote Service Platform
CWP	Customer Web Portal
DCS	Distributed Control System
DIN	Deutsches Institut für Normung e.V. (German Standards Institute)
DKE	Deutsche Kommission Elektrotechnik (German Electrical Engineering Commission)
DMZ	Demilitarized zone
FAQ	Frequently Asked Questions
HW	Hardware
IT	Information technology
KPI	Key Performance Indicators
LCC	Life Cycle Costs
LCS	Life Cycle Services
OS	Operating System
PC	Personal Computer
PLM	Product Lifecycle Management
PNC	Process-near components
SUS	Software Update Service
SW	Software
TCO	Total Cost of Ownership
VDE	Verband der Elektrotechnik, Elektronik und Informationstechnik e.V (Association of German Electrical Engineers).
ZVEI	Zentralverband der Elektrotechnik- und Elektronikindustrie e.V. (German Central Association of Electrical Engineering and Electronics Industries)

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