APPLICATION OF SOLUTION PROPOSAL FOR CHOSEN PROBLEMS THROUGH SOA

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Abstract

Article discusses the use of SOA approaches in solving some problems in production.. There are also requirements for industrial production as well as brief description of SOA, Web services and DPWS. Finally, there are described two solutions to problemsthat may arise in the manufacturing plant. Each example consist of classical and SOA solution of concrete problem and cosecutive conclusion of determined information.

Key words

production systems, manufacturing corporations, SOA, DPWS, integration

Introduction

The environment of future manufacturing enterprises will be characterized by frequently changing market demands, time-to-market pressure, continuously emerging new technologies and, above all, global competition. Therefore, next-generation manufacturing strategies must support global competitiveness, innovation, and introduction of new products, and strong market responsiveness. As a result, if cost and quality remain vital concerns, manufacturing systems need to become more strongly time-driven and time-oriented. This evolution requires considerably more flexibility and adaptability to change than present-day manufacturing systems can afford.

Currently, one third of the total cost of a manufacturing plant over its lifetime is spent on installation and setup. Maintenance downtime accounts for another substantial portion of the operating costs [1].

Future requirements of manufacturing

As has been indicated in previous section, future manufacturing needs will lead to:
- Reduction of costs and time needed for adaptation to market requirements.
- Support of heterogeneous yet interoperable hardware and software environments.
- Cross-enterprise cooperation.
- Scalability by adding resources without disrupting operations.

- A device shall be readily reusable at various architecture levels.
- It shall be possible to connect devices together without extensive installation procedures (plug-and-play connectivity).
- Interactions shall be made predictable (real-time demands).

SOA (Service Oriented Architecture)

SOA represents an open, agile, extensible, federated, composable architecture comprised of autonomous, QoS-capable, vendor diverse, interoperable, discoverable, and potentially reusable services, implemented as Web services.

SOA can establish an abstraction of business logic and technology that may introduce changes to business process modeling and technical architecture, resulting in a loose coupling between these models.

SOA is an evolution of past platforms, preserving successful characteristics of traditional architectures, and bringing with it distinct principles that foster service-orientation in support of a service-oriented enterprise. [2]

Common tangible benefits of SOA

Improved integration (and intrinsic interoperability)

SOA can result in the creation of solutions that consist of inherently interoperable services. Utilizing solutions based on interoperable services is part of service-oriented integration (SOI) and results in a service-oriented integration architecture [2].

Inherent reuse

Service-orientation promotes the design of services that are inherently reusable. Designing services to support reuse from the get-go opens the door to increased opportunities for leveraging existing automation logic [2].

Streamlined architectures and solutions

The concept of composition is another fundamental part of SOA. It is not, however, limited to the assembly of service collections into aggregate services. The WS-* platform is based in its entirety on the principle of composability [2].

Organizational agility

Agility is a quality inherent in just about any aspect of the enterprise. A simple algorithm, a software component, a solution, a platform, a process—all of these parts contain a measure of agility related to how they are constructed, positioned, and leveraged [2].

Web Services

A Web service is a software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format (specifically WSDL). Other systems interact with the Web service in a manner prescribed by its description using SOAP messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web-related standards. [3]

In normal case the WSDL is sufficient for building web services. Unfortunately, Web services do not bring Plug and Play capabilities and a sufficient solution (spec and guideline) for device integration. This is overcome by DPWS.

The **Devices Profile for Web Services** (DPWS) defines a minimal set of implementation constraints to enable secure Web Service messaging, discovery, description, and eventing on resource-constrained devices.

Its objectives are similar to those of Universal Plug and Play (UPnP) but, in addition, DPWS is fully aligned with Web Services technology and includes numerous extension points allowing for seamless integration of device-provided services in enterprise-wide application scenarios. With this specification is possible to bring web services to lower level of manufacturing.

Application of choosen problems solution proposal

Following examples shows the differences between classical (used by now) ways and possible advantages of SOA using in manufacturing corporations.

Example of failure on production line

This example shows failure on production line which has assigned date up to which must produce concrete kind of good (material, components) for customer. Expose what problems can apear in conection to this failure and its impact on production, management and whole company.

Solution of failure on production line in classical way

By using of classical method, solution is following. Production line functions certain time without problems. After some time disturbance of some part can appeare - for example disturbance of welding arm. After failure is shown with abortion of production, operators which analyse the reasons why and how failure originated are called. Corretion of failure is made then - what can in this case means change of welding arm. This change can takes few hours. Production is activated again after elimination of failure.

Problem apears after 2 days when manager, who was informed by customer about production abortion, comes to production. Customer complains on late delivery of his order.

This problem could have been prevented if manager have knowned about abortion of production line. Manager could have placed this production to another production line or could have contacted customer and informed him about possible late delivery or about other solutions.

Prevention of this problem may also be in fact that service engineers know about possible failure forwardly. They are then able to come and solve failure without abortion of production line.

As main problem we can consider communication gap between concrete levels in company but also in individual lays. Picture 1 shows whole process.
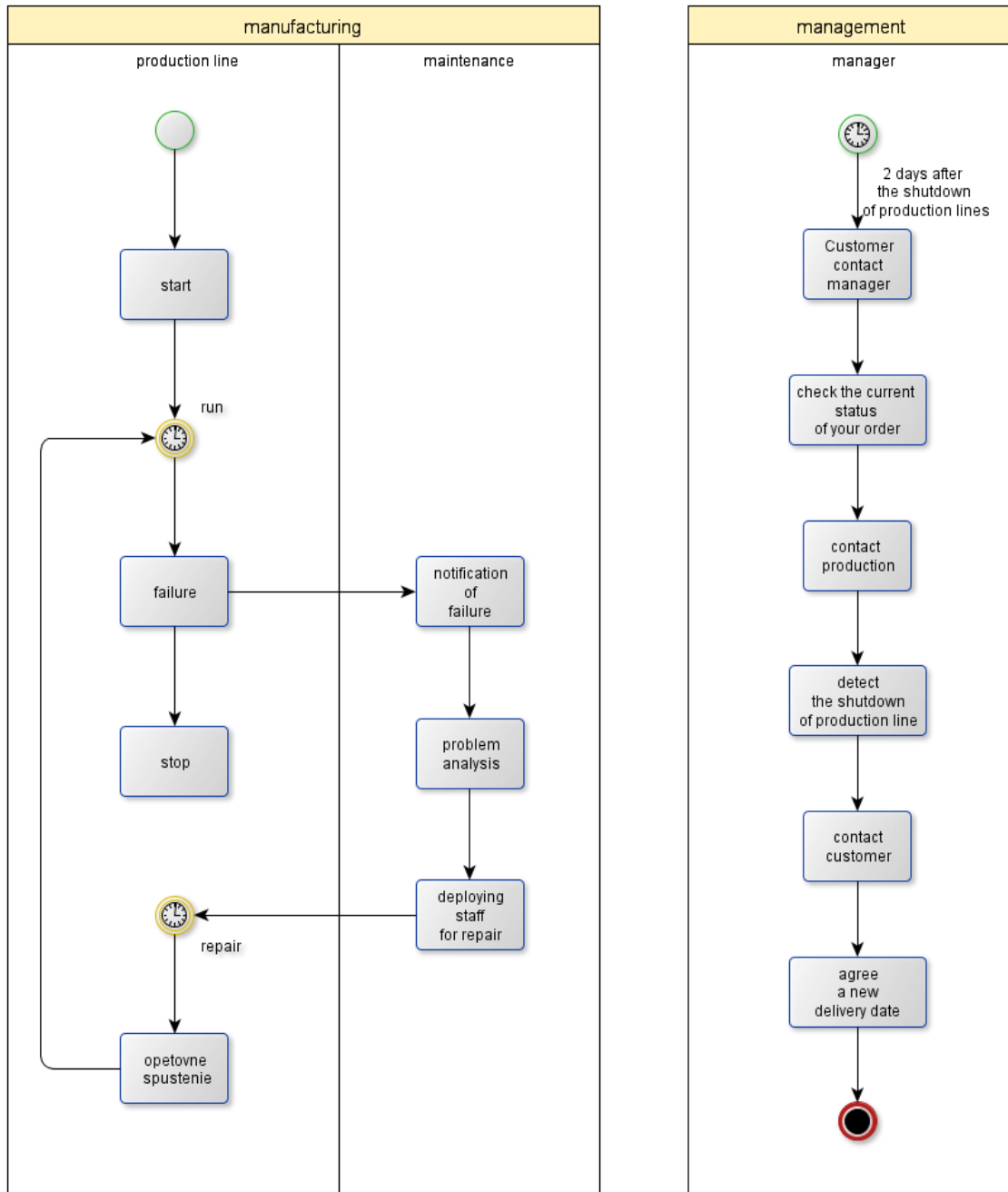

Fig. 1 *Solution of failure on production line in classical way*

Solution of failure on production line by SOA

Same problem can be solved in following way. Adequate flow of information to predict some states can by provided by using of SOA. Using of sensors supporting web services on some parts of production line can prevent from failure before its formation. When sensor notes defined changes, sends information via web services to maintenance centre. For example in case of welding arm overheating can mentioned way prevent from failure. Mainentenance centre can send operators which can solve this failure without abortion of production line or without damages.

At the same time (when maintenance gets information about failure of production line) sends web service this information to higher levels of production also (management). In due to this manager can react on concrete problem by proposal of temporary displamcement of production to another equipment or production line. Manager can also contact customer involved with possible abortion of production line, propose compensation or arrange other date for order delivery. Picture 2 shows whole process of problem solution by SOA

Conclusion of solving problem

Contribution of SOA application in concrete occurrence is accesing of information through individual layer of manufacturing corporation. Prevention of failures and conected damages is possible by using sensors supporting web services, this can save finances for purchasing of new appliances. Production character of production line can be easily changed by using of another parts of production line supporting web services.

Manager is able to behold what is happening in production in „real time", that means that he can react more flexible on each impulse. Manager can look for other solutions - how can the production be finished or contact clients and arrange improvements as it was described.

Example of stack filling with components

Example deals with filling of stack with components (production line, etc.) At the same time shows conected problem with supplying.

Solution of stack filling with components in classical way

To obviate abortion of production or to minimize production abortions constant supplies of material, components etc. is neccessary. Because of above meantioned reason responsible person who oversee this cycle is needed. Stack is controled in definite intervals, if define level of stack is detected, operator must fill stack. For filling of stack warehouse must be contaced on time and operator must ask for neccessary components.

Independently of expenditures, warehouse must control situation of stocks reserves and order missing material to avoid abortion of production. This means that operators responsible for material expenditures, orders of missing material and components are needed.
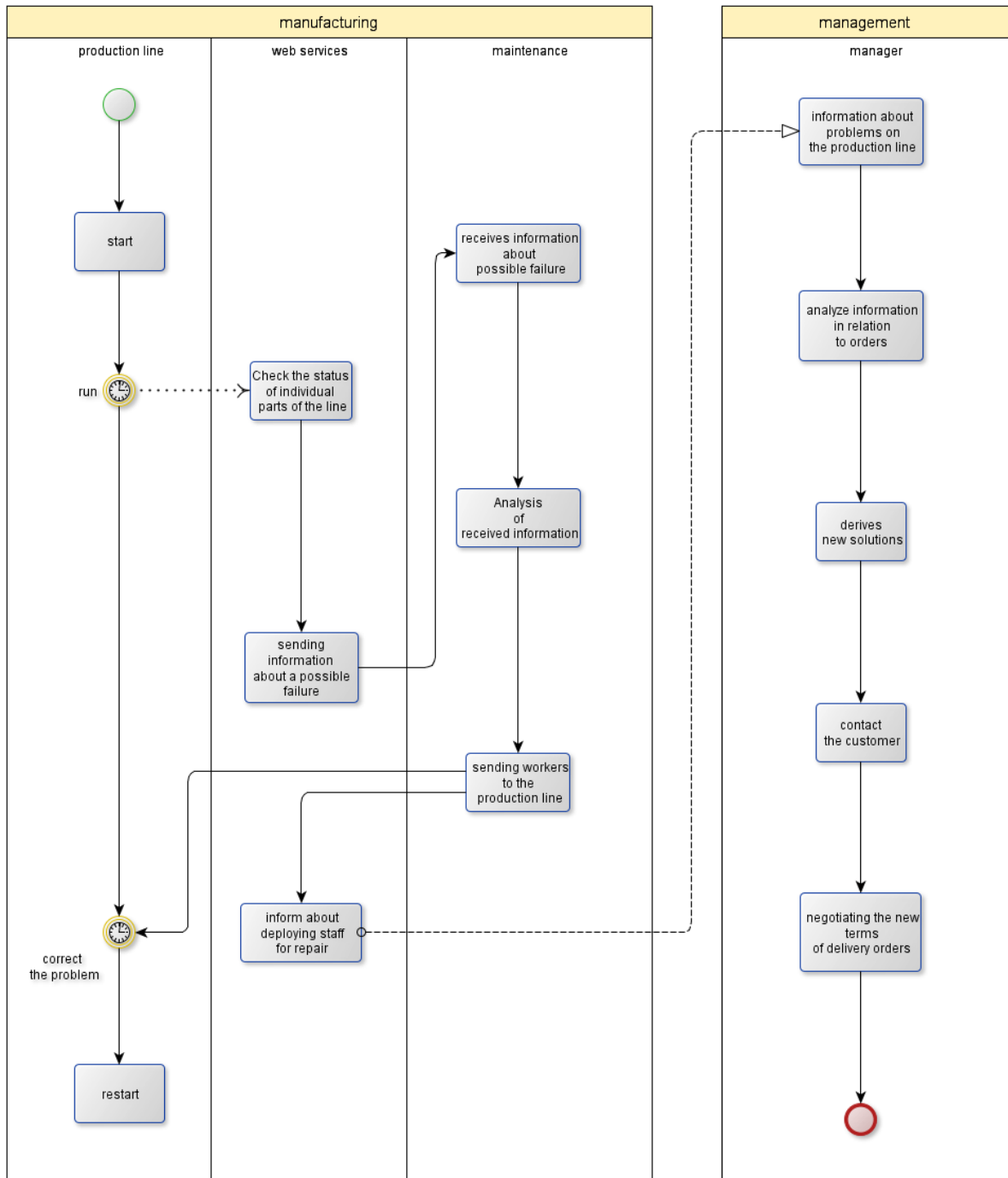
Fig. 2   Solution of failure on production line by SOA

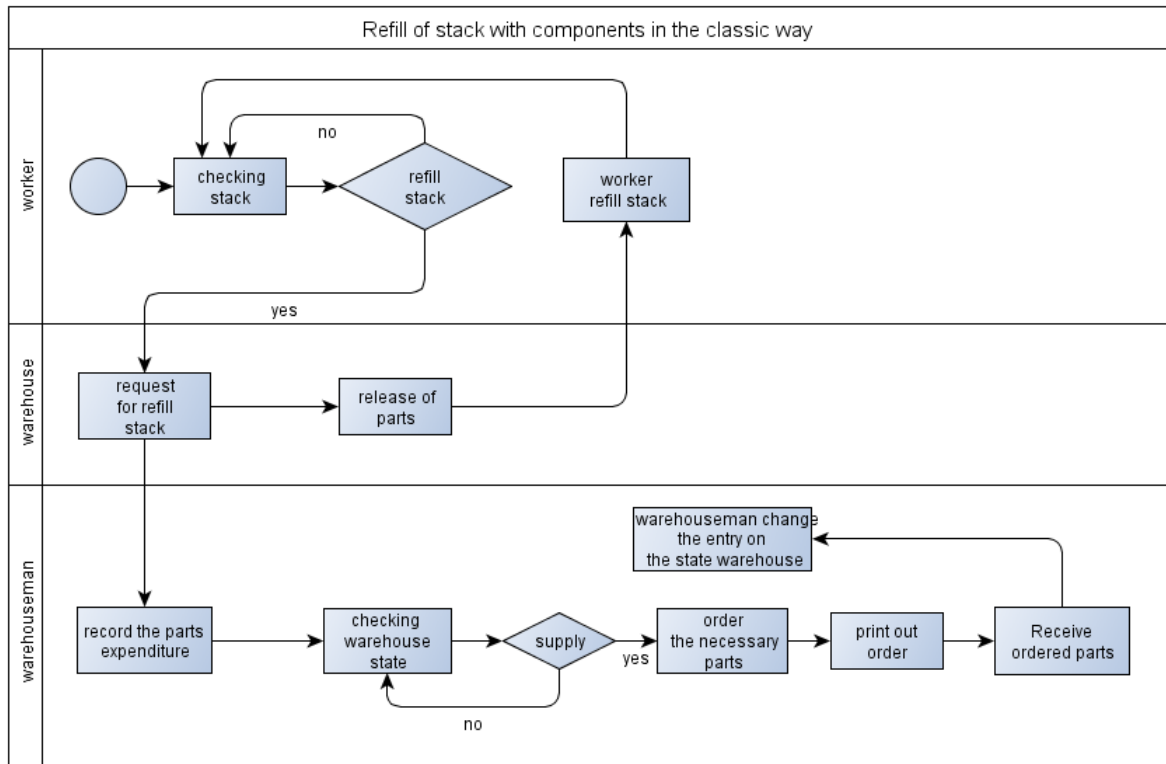Whole method of components filling is shown on picture num. 3.

Fig. 3 *Solution of stack filling with components in classical way*

Solution of stack filling with components by SOA

Using SOA for concrete solution means addition of sensors with web services support for concrete materials stack again . Sensor is adjusted on define level of stack, if stack reaches this level, sensor sends demand for filling of stack on warehouse via web services. This demand is handle warehouse by service which takes care of components expenditure. Operator who tooks and fills stack comes after demand processing and after expenditure of material.

For change of stocks reserves takes care web service, which does demanded changes in registration after acceptance of message from fill in reservers service. Other service takes care of writing up and sending of orders for needed material . Another service notes income of ordered material on warehouse and changes actual state of stock.

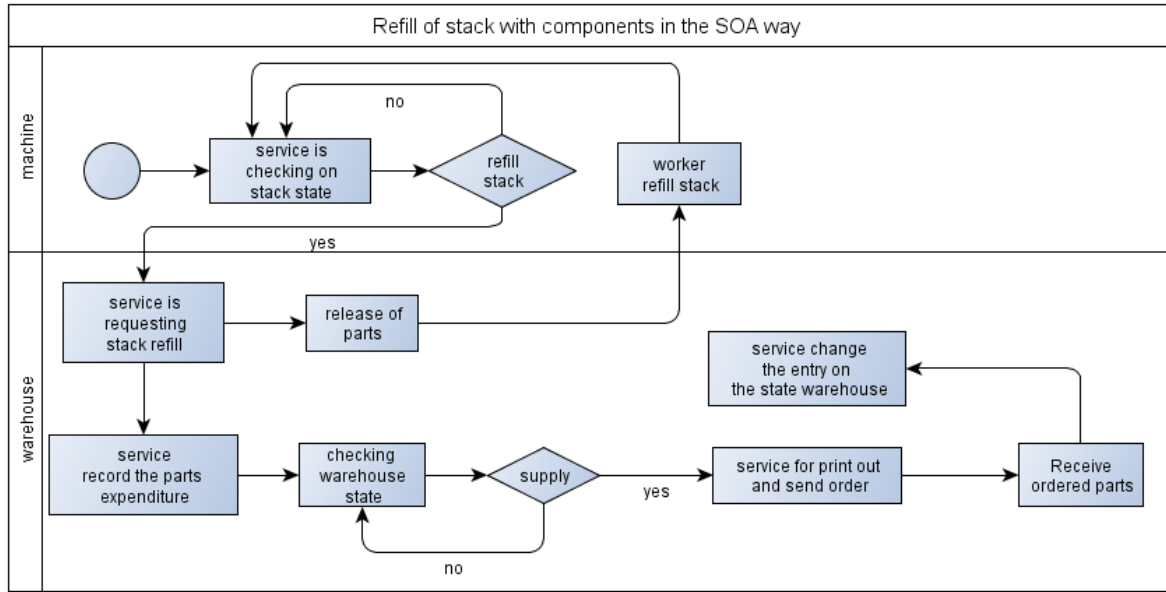Whole method of components filling with SOA is shown on picture num. 4.

Fig. 4 *Solution of stack filling with components by SOA*

Conclusion of solving problem

By using of SOA in concrete problem with filling of stack with components solving, company can save major labour costs for operators, who must continuously control each stack. Classical way of filling brings possibility of human factor failure, operator must not estimate correct time neccessary for stack filling and can cause abortion in production. Costs conected with incorect information about stock reserves can be saved by partial automatisation of some functions on stock.

By using of web services can flows individual information to higher levels of manufacturing corporation, where they can provide its better and more flexible running.

Conclusion

Article describes ways of solution of 2 defined problems in manufacturing corporation. Opportunities of problem solutions nowadyas and in future by using of web services and SOA are described. Advantages and disadvantages of SOA are possible to see from mentioned problems. Advantages are better flow of information between individual branches included, simplier addition of other services in to system and easier integration - integration not only in one operational lay of manufacturing corporation but in whole company. Individual services are accessible from particular levels of corporation because of open standart usings and advantages which brigs SOA and web services.

Companies like this can better react on market requirements and then easily keep its competitive on market. This may by reached by faster reactions on clients demands and by shorter periods of operation changes, better flow of information in whole company etc.

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