

# Configuration of Contract Based Services

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**Abstract.** Satisfying needs of individual customers by mass-customizing services has been proposed. Although configuration, i.e. specifying a product individual as a combination of pre-defined components, is an important way of achieving mass-customization to industrial goods producers, there is relatively little literature on the applicability of the configuration paradigm to services. In this paper we take a step towards understanding if services could be managed as configurable products. The ideas presented in this paper originate both from existing literature and from our co-operation with four companies that participate in our 3-year research project on configurable services and IT support for service configuration. We show that at least in some contract-based service industries configurable services exist and are used for doing business, and we characterize the services, related processes and special requirements on configurators.

## 1 INTRODUCTION

*Configurable products* are one way to achieve the benefits of mass-customization. The design of a configurable product specifies a set of pre-designed elements and rules on how these can be combined in a routine manner without creative design into valid product individuals that meet the requirements of particular customers [1,2].

*Services* are products with a significant service dimension e.g. [3,4]. Research on *configurable services*, and development of *configurators* [5] particularly suitable for these, is relatively limited [6, 7,8,9,10,11,12,13,14,15,16]. It is not known if the special characteristics often attributed to services i.e. intangibility, perishability, simultaneity of production and consumption, and heterogeneity [17] hinder the development and deployment of configurable services.

### 1.1 Practical Motivation

Services are often adapted according to properties of the customer, other stakeholders or related equipment. "One size does not fit all". On the other hand, it is not realistic to fully customize for all customers. For example, fully customized insurance terms for each customer would call for uneconomical resources of insurance mathematicians, lawyers, etc. Similarly, high-volume telecommunications services such as business-to-consumer (B2C) mobile and broadband subscriptions cannot be individually modified for each customer as they must be deliverable through automatic platforms. Therefore a mass-customization approach is often desirable.

Companies today outsource ever more diverse functions but don't want to spend time and effort in the process. Often full customization is optimal from the customer needs satisfaction point of view. But even customers may perceive fully customized solutions expensive and sub optimally accessible, potentially inconsistent and

poorly documented. Further, the time and effort sacrifice in specification may be too much. For these reasons, mass customization may be a lucrative option for customers.

A theoretically promising means to achieve the benefits of mass-customization, service configuration, also has practical relevance and potentially wide applications in a number of industrial contexts. Contract based services are an interesting area to study this phenomenon, as opportunity to elicit customer requirements [18] and observe customer behavior may be better in a contractual customer relationship than in a one-off transaction.

### 1.2 Goals, Research Questions and Method

Many configurator vendors claim support for configuring services [19], yet few examples of configurable services have been documented in scientific literature. Our long-term goal is to allow cost-effective, semi-automatic or even automatic mass-customization and individualization of services through the web by modeling and managing them as configurable service product families. In this study our research questions are:

- (1) Can services be modeled and managed as configurable products?
- (2) What can be varied in configurable services?
- (3) What processes are related to configurable services?
- (4) Do configurable services pose any special requirements on configurators?

In this work we concentrate on services that are performed on the basis of a contract. We considered such services to potentially benefit most of the application of the configuration paradigm and configurator support.

We used qualitative case studies as our method, the four case companies are service providers participating in our 3-year research project on configurable services and their IT support. We have conducted empirical studies through participant observation and open semi-structured interviews in the companies. Further, we experimented modeling some of their service offerings using a configurator designed for physical goods.

Two cases are services offered by manufacturers of configurable equipment: industrial process equipment maintenance services, and information services of configurable heavy industrial equipment, both in business-to-business (B2B) setting. The third case involves insurance and other financial services, and the fourth case telecommunications services, both representing B2C offerings. The cases have some special service characteristics: The equipment related cases involve a significant goods dimension. The financial service company has a near maximal service dimension in their products. The telecommunications case has automated service delivery.

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## 2 CONFIGURABLE SERVICES

In this section we first discuss the general structure of our case services, relate that to research question (1), and proceed to consider what is varied to answer the research question (2).

### 2.1 General Structure of Configurable Service Products

In the following we describe how the services of our cases can be conceptualized - there is a strong analogy to configuration of physical products, and we studied if the same ideas apply.

With physical products the execution of a configuration process produces a specification of a product individual that specifies a number of components (individuals), their compositional structure, parameter (attribute) value assignments and possibly connections between the individuals, see e.g. [20].

In contract based services we were able to identify service elements that corresponded to components. Some service elements were parametric (configurable) and compositional structure could be identified. However, the compositional structure was simple and shallow in our case products. In the compositional structure (at configuration model level), *optional service elements* that can be included or left out were common and *alternative service elements* that are mutually exclusive were encountered. For example, the broadband connections have optionally available SMS-sending via Internet, and increased space for e-mail. An example of alternative service elements in broadband subscriptions is security, the customer can select no security or one of 3 alternatives: virus scanner, virus scanner + firewall, or virus scanner, firewall and spam + content filter. An example of a configurable parameter in the maintenance case is a guaranteed response time in case of a breakdown. It can be selected from 2, 4 or 8 hours. In maintenance services, assisting work-force for official inspections arranged by service provider is an optional service element.

The case services formed "service product families" where the individual members were similar but different in some respects. The general compositional structure was almost identical and same parameters applied to (most) members of the family. A specific service element can be always *included*, *available* optionally or as an alternative, or *not available* at all in some products or service elements. Each service product family contains major fixed service elements, typically the core service and some bundled additional service elements. For example, in our case ISP service products for consumers, speed and connection technology determines a product in the offering, e.g. 512kbit/s ADSL is considered one product and 1 Mbit/s / 256 kbit/s Cable broadband is another product. E-mail, a dictionary, an encyclopedia, internet- news, and IRC services are included in all the products. Often more expensive service products include additional bundled service elements available for additional price or not available at all in lower-end service products. For example, a fast broadband connection includes free access to an electronic phonebook that is not available in the slowest (and cheapest) connections. Similarly, applicable parameters and parameter domains can change by product or service element. E.g., the availability of response times depends on the selected service product - the fastest response times are available only with the more comprehensive maintenance contracts, and the minimum availability of maintained equipment is not specified in a basic maintenance contract.

The case products have few requires- or incompatible-relationships between service elements or characteristics. Relationships of products, service elements or characteristics to customer and/or equipment characteristics are common. For example, avail-

ability or pricing of some characteristic value may depend on the related customer. We did not encounter any need for resource-constraint-type of modeling. Need for connections or topological modeling was identified only in the sense that allocation of some responsibilities to different stakeholders could be modeled as connections to objects representing appropriate stakeholders. As these stakeholders can be present in several roles, one way to model them only once but in multiple roles could be through connections.

The above characteristics lead us to conclude that the described case service offerings can be considered configurable.

### 2.2 Variation in Configurable Service Products

Based on our cases, service products can be varied on a broad spectrum of issues within a predefined envelope of variety. Following the characterizations of Dumas et al. [21], we look at variation through the classical W's, including what, when, who, where, how, by whom, and why. A service element or parameter in a service can relate to several of these views. For example, a broadband connection must always be installed. Therefore selecting if a turnkey installation is performed affects both the what-view (the scope of service), and the who-view (who performs the installation).

#### 2.2.1 What-variation

Often what-variation relates to the scope of the service: are some optional elements included or which of alternative scopes is selected. Some examples were given above. Further, insurance policies may vary on what is covered, against what risks, and on maximum coverage.

The what-view may also relate to pricing: what is included in the periodical fee, and what is charged on by-use basis. For example, maintenance contracts have a number of alternative amounts of repair work covered by a periodical fee.

#### 2.2.2 When-variation

When-variation relates to the temporal aspects of a service or some of its elements. Such aspects include availability, pricing or response performance. For example, in the maintenance cases evening or weekend repairs can be selected or left out. The temporal aspects may affect the whole service or some of its elements. For example, in our maintenance case emergency services are available all the time, but regular repairs may have more limited temporal coverage.

When-variation can also relate to response-times. For example, in maintenance services it is possible to specify whether repair begins within 2, 4 or 8 hours after breakdown.

#### 2.2.3 With what? Who? How?

The human and physical resources used for a service and assignment of responsibilities to different stakeholders offer sources for variation. Further the way some service elements are delivered may be varied.

In our broadband case there are two main technologies for core service delivery - ADSL via telephone network and cable modems via cable network. These can be seen as configurable method for service delivery.

In the insurance case there is a budget-oriented car insurance product where repairs are performed with third-party parts and the insurance company selects the repair shop. In normal cases original parts are used and the insurance holder may decide where the repair is performed.

In our cases, by who-variation was related to the scope of service

– the what-view. In other words, some element of the service may be assigned to the service provider or to the customer.

In our cases, reporting and payment are sources of with-what and how -variation. In maintenance services it is possible to specify with what and how stakeholders are informed about major maintenance events. For example, e-mail and/or SMS can be sent to specified stakeholder(s) when a breakdown has been repaired. Billing can be configured to be electronic or regular paper-based, and payment can be regular or direct-debit.

#### 2.2.4 To Whom –variation

The service recipient –be it a human or equipment- is specified always in our cases. A service product may have relations to a number of stakeholders that may or may not be explicitly defined. Actual variation of the service based on the to-whom view is less obvious in our cases. In some cases the delivery process is affected - e.g. security regulations may require two service technicians instead of one to perform some tasks if specific properties are present in the equipment to be maintained. Further, some service elements or possible values of characteristics are targeted to specific segments or types of customers. In addition, the availability of some service elements may depend on properties of the customer and/or equipment. For example, all-inclusive maintenance contracts are not available for old equipment, and medical insurance may not be available to persons above a specific age.

#### 2.2.5 Where –variation

Service delivery location may be a source of variation and have significant effect on total customer sacrifice. Some training services of one of our cases can be configured to take place at customer premises or at service provider's premises. Large equipment is maintained on-site, but for smaller equipment a choice may be offered.

#### 2.2.6 Why –variation

We did not encounter any explicitly why-view related sources of variation in the configurable service offerings.

### 2.3 Specific common sources of variation

In this subsection we discuss some sources of variation that may be present in many different types of configurable service products. These include pricing models, information and reporting, paying and billing, ownership and intellectual property rights, service quality attributes, and loyal customer benefits.

Pricing models for services and products are a complex phenomenon, a related body of literature has been analyzed e.g. by Miranda [22]. We encountered three basic types of price elements: one-time, recurring (periodic), and pay-by-use. *Initiation price elements* are paid once, typically when the service contract is initiated. For example, telecommunications services often have an initiation fee. *Periodic price elements* such as monthly or yearly fees are common in our cases. *Pay-per-use price elements* are also common. For example, mobile phone calls may be charged by use.

Allocation of total service cost to different kinds of price elements varies significantly. In our case services initiation fees are relatively insignificant. Allocation to recurring and pay-per-use elements varies significantly. In minimal mobile subscriptions without bundled phone calls or other extras the periodic (monthly) price element is small and basically just covers that mobile services are available and billable. At the other extreme, periodic payments

in insurance services cover the whole service fees.

In our cases each service product has an associated pricing scheme that can be fixed or configurable. A pricing scheme may contain initiation, periodic and pay-per-use elements. Often different combinations of periodic and pay-per-use are offered –increased periodic payments include increased amount of use or offer reduced pay-per-use rates.

Sometimes a number of configurable service products differ significantly only in pricing. For example, a mobile subscription may have a specific price when calling to the same service operator's network, and a different price when calling to other networks. Another mobile subscription may have a flat rate to all networks. These different service products can be configured to behave exactly the same way except for pricing.

Information and reporting can offer significant value, or when performed poorly, increase significantly total customer sacrifice. Here too, one size does not necessarily fit all. Information and reporting on services are thus a potential source of variation. In our maintenance case, configurable notifications from service events help the customer-side to be informed on the status, e.g. in case of equipment breakdown. The scope of information and reports available to customers via extranet can be configured. Even alarms on repair costs exceeding a pre-determined value or number of faults can be provided.

Paying and billing are also sources of variation. To some customers of our case companies a configurable number of payments and due date may offer extra value. Bills may be standard paper-based or electronic, and payment options may include e.g. direct-debit in addition to regular payments. Information on what forms the payments (e.g. more detailed itemization of per-use charges) may also offer configurable options. Further, some customers value bills where a number of separate billing targets are billed simultaneously and information is grouped as desired.

Ownership and intellectual property rights (IPR) of information or intangible deliverables can be sources of variation. For example, who owns databases gathered in remote monitoring of equipment or detailed maintenance history? Currently these are not configurable options in our cases, but at least in one company they have required case-specific negotiations.

Service quality attributes such as performance, dependability, security and safety can be sources of variation. For example, basic maintenance contracts do not guarantee availability while higher-end contracts include increasingly higher guarantees on availability. In a similar way, some temporal when-aspects such as how fast repair starts after a breakdown can also be considered quality attributes. Broadband connection speed directly affects the performance of the service.

Various loyal customer benefits can be offered. One of our case companies offers a number of mutually exclusive benefit programs.

## 3 PROCESSES

In this section we discuss the processes related to our case services to answer our research question (3). Again, we see a strong analogy to previous findings in configuration of physical goods [1].

### 3.1 Sales / specification process

Contract based services in our cases have a similar sales phase (specification phase) as configurable goods where the service along with its price is specified. The configuration task produces a contract and possibly some non-contractual additional information

elements.

Based on our mystery shopper experiences and interviews at our consumer market companies, and to some degree in maintenance contract sales, current sales processes have several challenges.

Sometimes the sales process tends to be product-centric. The persons at customer interface may start introducing and selling individual service products instead of analyzing the actual needs or requirements of the customer. For example, in a number of cases a potential customer who had made an appointment for comprehensive analysis of insurance-related needs was met with a clerk who started selling some specific insurance policy for a specific (assumedly) needed coverage.

Service product options considered less important by the person at customer interface may not be offered at all. For example, mobile subscriptions include a significant amount of optional value-added services of which only a small subset were offered.

Consultative mode of selling is felt desirable in at least two of our case companies. The idea is to find out relevant properties of the customer and other stakeholders, related equipment and environment as well as needs to be able to recommend a suitable service solution. It was felt that this could alleviate some problems of product-centric sales events.

Services for consumers were available through several sales channels while B2B maintenance and information services were sold only directly by the service provider. Service pricing to customers had little room for bargaining while the maintenance services were typically priced case by case. In telecommunications services and insurance services a contract proceeded automatically via IT support to delivery process (telecommunications service provisioning, insurance contract activation).

### 3.2 Reconfiguration

Managing reconfiguration seems to be more important in contract-based services than with most industrial goods. Long-term relationships between the supplier and customer are a norm. Often the service must be adjusted when customer needs, equipment, environment or other relevant aspects change.

On the other hand, management of reconfiguration may be easier in services than in goods, because the primary target of configuration is not a physical product individual. Therefore errors or inaccuracies in as-maintained configuration description, and condition of components are not as relevant. Optimization for maximally using old components is not necessary. Systematic “genuine” reconfiguration instead of project-based modernization requiring design may be possible more often. After a company changes its offering, it may be possible just to mass-update (map) old configurations to corresponding new ones in a way that makes reconfiguration within the new offering possible. Of course, this is not always the case, e.g. if the old configuration is not available in the new offering.

For example, in insurance and telecommunications services systematic reconfiguration is common. Telecommunications customers subscribe to new additional services or change their subscription type. Insurance related needs change and insurance policies need to be updated to reflect these changes.

### 3.3 Service delivery process

The service elements covered by a service contract may take place once, in discrete service events or continuously. In our cases service delivery process based on a single contract usually has repetitive discrete service events “moments of truth”. These discrete service

events can occur periodically with fixed periods (e.g. official inspections), periods determined by the customer and/or service provider (preventive maintenance based on a device-specific plan), or on demand (mobile phone calls). Some service elements such as turnkey installation of a broadband connection are performed only once. Insurance coverage or an always “open” broadband connection can be considered as continuous service delivery. Some of our case services include several types of delivery. For example, a broadband subscription user may also use value added services in discrete service events.

As discussed previously, configuration decisions may affect significantly the delivery process: e.g. what is done, when something is done, who manages or decides something, etc. Therefore information flows are important – service delivery process must act based on what was agreed in the specification phase. On the other hand, in one case we identified some parts of service delivery process that are not affected by the service configuration and can be performed without such information.

Service delivery processes of core services in our cases have a very different nature. In telecommunications, configured services are made available (provisioned). After provisioning, service delivery is automatic – the customer can use the service at will using his/her equipment. Even provisioning is (almost) automatic. Routine maintenance is performed for the customer without any active customer participation: the service person often even uses his/her keys and performs the necessary actions without presence or activities of the customer. In insurance services, there is no actual service delivery “if things go well”. Instead, there is just a promise to manage financial consequences of specified harmful events.

As exemplified above in the maintenance and insurance cases, contrary to traditional service definitions, customer participation does not always take place. On the other hand, educational services of the other heavy industrial goods manufacturer and turnkey-installation of broadband subscriptions include regular customer participation and simultaneous consumption and production.

Customer participation and role can be directly or indirectly configured – a broadband user may perform the installation or participate in the turnkey installation process.

### 3.4 Development process

The development process of services is normally separate from individual deliveries in our case companies. When introducing new services, there may be overlap in development and delivery processes. In at least one company the difficulty of piloting new contract based services or features was pointed out due to long-term nature of commitments made.

We have no case experience in these cases on new service development. Therefore there is little we can say on how the companies define the appropriate offering – what variation to offer, and how they develop capabilities to sell, price and deliver them.

## 4 APPLICABILITY OF CONFIGURATORS TO SERVICES

In this section we consider the applicability of configurators to services to answer our research question (4).

Most of the 30 vendors studied in [19] claim their configurators support services. Only two vendors describe their modeling concepts and neither introduces any service specific concepts. No modeling examples were found.

We experimented modeling of broadband subscriptions [19],

maintenance contracts, mobile subscriptions as well as some insurance policies with WeCoTin Configurator [23] that was designed for configuring goods. Modeling in WeCoTin is based on typed objects (components that can have attributes), compositional structure in a form of generic product structures, and constraints [23].

Modeling of contract-based service offerings as configurable products was possible without significant challenges. Based on our experiments and vendor claims we conclude that at least some configurable service offerings can be modeled and configured with traditional configurators. However, we felt a conceptual mismatch in modeling because thinking in components did not seem natural for services. We did not model prices of the offerings. Instead of one price typical for goods configuration, our telecommunications case would require at least two – the initiation and periodical fees need to be kept separate.

According to our previous modeling experiences of physical products, modeling aspects external to the product itself is not usually needed. However, in our service cases, the customer or other stakeholders and/or related equipment, environment, or their properties must be modeled to verify that some services, service elements or some values for their characteristics are available or that they are priced appropriately. Therefore configuring a suitable service specification can be challenging. Recommendations, warnings, and possibly optimization could be useful. We applied the soft constraint mechanism of WeCoTin to warn when some recommendations are not satisfied. However, we felt that such warnings are displayed too late – we would have liked to have guidance towards the good solutions.

Supporting reconfiguration seems to be a business requirement for configuring some contract-based services. For example, B2C telecommunications services require such support as volumes are so high that automated reconfiguration support is a must. We did not address reconfiguration in our modeling experiments.

In some cases it seems that modeling service delivery processes and resources in the sales phase would be beneficial and would thus require appropriate modeling support.

## 5 PREVIOUS WORK AND DISCUSSION

In this section we first compare our results to previous work and then briefly discuss some of our findings.

Service configuration based on pre-determined specification options and/or delivery modules, possibly supported with configurators, has been at least a partial goal in several papers. Of these, configuration of maintenance services of industrial goods are discussed in [13,14], configuration of financial services in [10], and insurance in [12,24], and customization of IT services in [15]. Moreover, the ILOG JConfigurator has been used in financial services and insurance configuration [25] and telecommunications services have been configured with the CAWICOMS Workbench and WeCoTin [26,19]. These papers support that services can be managed as configurable products in our case company service domains: financial, insurance, maintenance, and telecommunications services. Further, travel is a domain of interest in [27,28]. Combining services from pre-determined modules is suggested for IT consulting services in [11]. Service configuration in general has been discussed in [9,29] and a configurators intended for both physical and service products were described in [30,19]. The work of [9] has been applied in a case bundling energy services with broadband access [31].

Dimensions of service variation have been discussed by several authors. Different types and sources of variation in services and how to manage or limit their consequences in service delivery have

been discussed by Harvey et al. [7] and McLaughlin [32] in service management literature. Their focus is on the management and structuring of the service delivery system and process whereas our focus in this work is on defining the dimensions along which configurable services specifications can vary. The non-functional properties of services have been discussed in [21,33]. Some identified properties such as rights to terminate the contract prematurely were not present in our cases - at least not as configurable characteristics.

The requirements for conceptual modeling of configurable services in configurators are discussed in [29, 9]. Both have a high-level process perspective that is new to configuration conceptualizations. Further, capturing the relevant customer characteristics is stressed in [29], a perspective also absent from previous work. In [34] the mainly goods-based product configuration literature has been reviewed for the benefits and challenges related to product configuration and configurators. The paper provides a conceptual analysis of whether the found issues are relevant in service settings.

Our cases did not offer who-variation on personnel attributes that deliver the service (e.g. qualifications or skills), or with-what characteristics of physical elements or equipment used in service delivery (e.g. quality or sophistication of equipment used). This was considered somewhat surprising as such examples are easy to find from other industries.

Why-variation was not present in the service specifications. Selecting a suitable specification could benefit from the why view, e.g. selecting a broadband subscription based on intended use and existing services can benefit from this. However, obtaining and understanding real customer needs can be difficult [35].

## 6 CONCLUSIONS AND FUTURE WORK

In this paper we discussed the phenomenon of configurable services from the point of view on service and process variability. Configurable services are one way to offer mass-customization of services. Similarly as in physical products, configurable services fill a gap between fully customized services (e.g. consulting projects and other professional services) and mass-services (e.g. electricity and other utilities for consumers or mass-transit).

We looked at some contract-based services where service delivery takes place on an ongoing basis based on a contract specified as a combination of pre-designed elements. The offerings of some of our case companies can be clearly considered as configurable.

Similar processes as in physical products can be identified in contract-based services. The development process is separate from sales (specification) and delivery based on such a specification. There is a separate specification phase where sales configuration takes place. Service delivery takes place repetitively based on a specification. Reconfiguration seems more significant but often easier than with most physical products.

Configuration modeling based on compositional structure, taxonomy, attributes and constraints can be used for modeling the service offering of our cases. Our case services are easy to configure in the sense that there are few strict constraints on the service itself. However, there are many constraints on what services, service elements, or service characteristics are available or are suitable for customers and/or owned equipment (or their characteristics). Generic product structures can be used in modeling of services. However, the conceptual match to service elements is not direct.

IT supported consultative selling could potentially offer significant benefits to some of our case companies. Adequate IT support for that must be able to deal with strict constraints, recommendations, and possibly optimization.

There are many fundamental subjects requiring further work in

service settings. When service is configuration a viable business option? How to decide what variation to offer? Some of the metrics presented in [35] could provide answers. However, the metrics are geared towards goods and manufacturing. It should be studied if customer participation in production, lack of inventories, intangibility and other service characteristics influence the metrics. How to develop configurable services? How to modularize them? How common and severe are service configuration errors in practice? How configurable services affect the way companies should organize themselves? How do intangibility, perishability, simultaneity of production and consumption, and heterogeneity of services [17] hinder ability develop (and deliver) configurable services? For example, can the experience or personal interaction be configured due to potential variation caused by heterogeneity caused by personal properties of service delivery personnel?

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