Value-Based Business-ICT Aligment: A Case Study of the Mobile Industry

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Abstract: The problem of business-ICT alignment lays in the difficulty of matching needs and requirements of customers over certain ICT services with the offered ICT services of suppliers. Our aim is to provide clearly determined factors and guidelines that characterize the optimal alignment in the ICT domain. To do so, we combine the e3-value methodology with the so-called service ontology. The resulted technique helps to understand the distribution and exchange of value objects between actors and the complexity of services. To reason over a successful alignment between service needs and offerings and to generate optimal service bundles it is necessary to combine these two mentioned techniques. The question is whether this combination is also sufficient for our purposes in the ICT domain.

Keywords: ontology, e3-value methodology, value-based business-ICT alignment, service bundle

1 Introduction

Business-ICT alignment deals with the problem of matching business requirements with ICT services that may satisfy such requirements. In the recent past, significant research has been done on business-ICT alignment. For instance, Henderson and Venkatraman (Henderson, Venkatraman 1993) present a framework distinguishing four areas (‘business strategy’, ‘IT strategy’, ‘organizational infrastructure and processes’, and ‘information infrastructure and processes’) along two dimensions (`strategic fit' and `functional integration'). Although this framework is usable mostly on the strategic level to explain business-ICT alignment, it hardly takes a *constructional perspective* on business-ICT alignment. By constructional perspective we mean adequate (computer assisted) support for creating and maintaining well aligned businesses.

In this paper, we do take a constructional as well as operational point of view on business-ICT alignment, motivated by the increasing importance of networked value

constellations (Tapscott 2000).Value constellations, such as Cisco Systems or Dell, consist of a series of enterprises that jointly work on a value proposition to their customers. Constellations can be formed by separate enterprises, but also by large corporations, which often consist of profit and loss responsible independent business units.

From the perspective of business-ICT alignment, it is important to consider that formation of such constellations do not only require the creation of a joint value proposition to the customer. The integrated, supporting ICT of the constituting enterprises should be configured and created, too.

In building ICT-support for networked value constellations a number of considerations are essential. First, a networked value constellation can be characterized as a decentralized environment, which includes different enterprises, often with different (and also conflicting) requirements, without a single point of authority for decision making. Therefore, advanced support for distributed decision making on required ICT-support is vital. To our knowledge, there is no efficient, heterogeneous solution for such an alignment problem in the literature, which takes the described conditions above fully into account. Second, constellations are typically formed dynamically, e.g. to satisfy a specific customer need, and/or to address a market opportunity, which only temporally exists. Ideally, ICT-support for such a constellation should be provisioned on demand and setup of such support should happen quickly and efficiently. This is in line with the vision from semantic web (Berners-Lee, Lassila 2001) and configuration of web-services, implying that the web itself should be capable, based on ICT needs, to configure and compose adequate ICT-support using web-services. This requires automated facilities (e.g. a market place) for the composition of ICT services. Third, constellations themselves may consist of enterprises offering jointly a proposition (e.g. a complex service) to a customer, and may also consist of a series of enterprises offering the required ICT-support to do so. In many scenarios, even the customer proposition might be to a large extent an ICT service itself (e.g. a computer game, or a hosted content such as music and/or movies). As such, ICT services themselves can be seen as (part of) valuable commercial propositions and, thus, are subject to normal commercial trade- and related procedures.

To address business-ICT alignment in networked value constellations, we envision a web-based (yet economic value aware) approach. In such an environment enterprises dynamically configure, and select (potentially) third party ICT support satisfying their ICT-business needs. This approach for ICT-provisioning is largely supported by ICT itself, e.g. based on web-services technology.

The remainder of the paper is organized as follows. Section 2 outlines the ontological approach we employ with respect to business-ICT alignment. This paper is a first

attempt to study the usefulness of some ontologies we developed during early research. We do so by using a small case study, which is presented in section 3 we describe our case study in more details. Section 4 introduces our economic value driven business model based upon the *e³-value* ontology and methodology. We use this technique to demonstrate the value-based alignment problem in the ICT domain. We identify the customers and the suppliers as the actors of the model with respect to offered and required services. We define the value objects of the model and discuss their validations. Following the description of our model, section 5 presents the problem of business-ICT alignment with respect to our depicted scenario. We introduce guidelines to reason over its sufficient resolution. In section 6 we draw conclusions and discuss potential directions of future research in the area of value-based business-ICT alignment.

2 An Ontological Approach to Business-ICT Alignment

In order to support dynamically alignment of ICT-needs with supplied ICT services we use already existing ontologies developed in earlier research. The term *ontology* is borrowed from philosophy, where an ontology is a systematic account of existence. In the realm of information systems, ontology has a somewhat different interpretation: an ontology is not a theory of what exists, but what a community of practice believes to exist. This is close to the opinion of Quine (Quine 1961), who argues that an ontology specifies things that everyone must assume to exist in order for our theories to be true. We will call in the following, what people believe to exist, *conceptualization*. A conceptualization represents an abstract, simplified view of the world. In our model, the simplified world is the world of ICT-needs, ICT services, and the alignment and matching of these. More recent definitions of ontology emphasize that there must be an agreement on the conceptualization that is defined as: '*An ontology is a formal specification of a shared conceptualization*' (Borst 1997, p. 12).

This notion of shared conceptualization is important to us, because we aim at a shared understanding of ICT needs and the services by stakeholders involved. Additionally, once we have a conceptualization of ICT needs and services, we can highlight conflicts in various needs that enterprises may have – and try to resolve these.

Our work is based on a previous research by Gordijn and Akkermans (Gordijn, Akkermans 2003), in which the *e³-value* method was developed. This method helps to demonstrate a network of enterprises performing value activities and value exchanges and helps to explore the consumer/supplier-oriented structure of services. The *e³-value* methodology allows to consider a constellation on the *business value* level: it shows

objects of economic value, being in our case ICT services that are offered and consumed. First and foremost, the idea is to create alignment on this business value level since economic value is in other commercial trading settings also the foundation for alignment between (service) customer and (service) supplier.

To describe ICT services in more detail, as well as potential *bundles* of ICT services, a generic, supplier-oriented service ontology is used, which is based on the research work of Baida (Baida et al. 2004). Such an ontology supports the component-based description of service offerings and shows the relations between such components. Both of these above mentioned techniques have already been used successfully in applications to the electricity and entertainment industries. In the following, we want to assess its usability to (1) model ICT needs and services, and (2) to reason about alignment.

The seminal work of Baida (Baida et al. 2004) focuses on the supplier side of services. ICT-alignment however requires also a consumer side (for alignment purposes). Consequently, we have to extend Baida's ontology with a so-called customer-oriented service ontology that focuses on the customer's (i.e. business) ICT needs. Our aim is to describe clearly the desired customer demands and the resources that are required for and/or produced by available services with the attributes of this technique. The advantage of such a deterministic modeling technique is that it helps to define clear relations between the attributes, which are domain specific for ICT services. Moreover, the implementation of a software-supported reasoning tool for value-based matching of ICT services that is well integrated with *e³-value*, will be possible. Based upon the customer-oriented service ontology, efficient reasoning between ICT needs and ICT service offerings is foreseen in order to enable the business-ICT alignment in a networked environment. Additionally, the *e³-value* method will be capable to monitor value-exchanges and value activities at the customer's side in more detail.

However, business-ICT alignment in a networked constellation is a far more complex process than just simply matching ICT needs with service outcomes. It is influenced by different factors, e.g. existing software-hardware architecture, technical support, financial benefits, functionality and the quality of services. To conceptualize the offered ICT services as value objects of the customers seems to be a more challenging idea since it requires the clear understanding of human needs. Another difficulty of our research is caused by different interpretations of the ICT services. Customers and suppliers often do not share the same view on how ICT services are defined. In addition, customers use different terminologies to define their needs compared to the more technical terminology of the suppliers. The challenge of our research is to realize a basis of shared knowledge over service demands and offerings.

For a specific case study, we present the business value model at hand, conceptualize the ICT service needs and supplied ICT services, and show how the current value and service ontology can be used to reason about alignment. Our primary goal is to assess whether our current ontologies are of any use for conceptualization and reasoning about the value-based alignment, as well as their possible extensions.

The presented research project involves many different scientific disciplines. We are planning to use tools of requirement engineering, to focus on conceptual modeling techniques and ontology development, and to apply concepts and terminology from business modeling, service management and marketing.

3 The traveling salesman

To understand the customers' needs and demands in more detail, to exploit the desired ontology and to analyze the value-based ICT alignment, we are closely co-operating with the industry. Using the gained information and experience we are able to address our research questions and achieve our main goal. Case studies can be defined as written summaries of real-life situations, based upon provided data and research. They offer a valuable way to share experiences and to encourage discussion about problem-solving strategies. In this paper, we will present a case study jointly done with inspired on information obtained from the mobile group of Cisco Systems.

The case is about the "traveling salesman" problem: A salesman that travels internationally and wants to have wireless Internet access in his hotel. .His demand can be satisfied by using different solutions provided by different suppliers. The traveler has the chance to choose from these solutions.

Our case study describes the following simple scenario. The traveler has the opportunity to book a hotel room with the so-called hotspot device. This device is able to establish wireless connectivity to the Internet. As the traveler chooses for the hotel room with the placed-in hotspot device, he receives only the facility of required service from the hotel, the service provider is the telecommunication company that maintains the physical connectivity to the Internet. Thus, for the end-customer, the required service is given by a joint service offer between the hotel and the telecommunication company.

The wireless network access can be established in other, alternative ways as well. The traveler can also use direct access via his mobile phone provided by IP-based UMTS services maintained by his mobile service provider. From the end-customer's point of view we restrict our model to these two mentioned possibilities, however, in real life

more alternatives exist. Nevertheless, to sketch and to analyze a typical problem of ICT-business alignment, these two cases serve sufficiently our purposes.

4 Business Model Alternatives for the Traveling Salesman: A First Step

4.1 A Base e3-value Model

We use the *e³-value* methodology of Gordijn and Akkermans (Gordijn, Akkermans 2003) to set up a business model for our case study of the traveling salesman. This methodology allows us to model the exchange of *economic values* that are encapsulated in *value objects* between various enterprises. In our specific case, value objects are valuable outcomes and requirements of ICT service provisioning. Due to the fact that ICT services, and – in our case more specifically the wireless Internet access – are *economic valuable services*, a first step towards business-ICT alignment is to understand the network of enterprises that exchange the wireless Internet access and related services. Moreover, we hope to apply in future research the *e³-value* ontology for reasoning over certain quality parameters, such as the efficiency of services. Figure 1 presents an *e³-value* model for the traveling salesman case study. The business model is generated by the *e³-value* tool, which can be obtained from http://www.cs.vu.nl/~gordijn/tools.htm.

Figure 1 shows that the displayed value-exchanges and distributions take place between *actors* (represented by rectangles). In our set-up, the actors involved are the hotel, the telecommunication company offering the facility for wireless access, the mobile service provider offering the facility for IP-based UMTS connectivity, the Internet Service Provider (ISP) maintaining the physical connection to the Internet and the traveler.

The value objects are being exchanged via *value ports.* In Figure 1 these ports are visualized by arrows while the distribution of value objects is expressed by connecting these ports. The labels of these connections show the exchanged value objects. Other important elements of our model are the *value activities.* These are the rounded rectangles that are representing activities, which are supposed to be profitable for the actor. An example for the value activities is the room renting of the hotel.

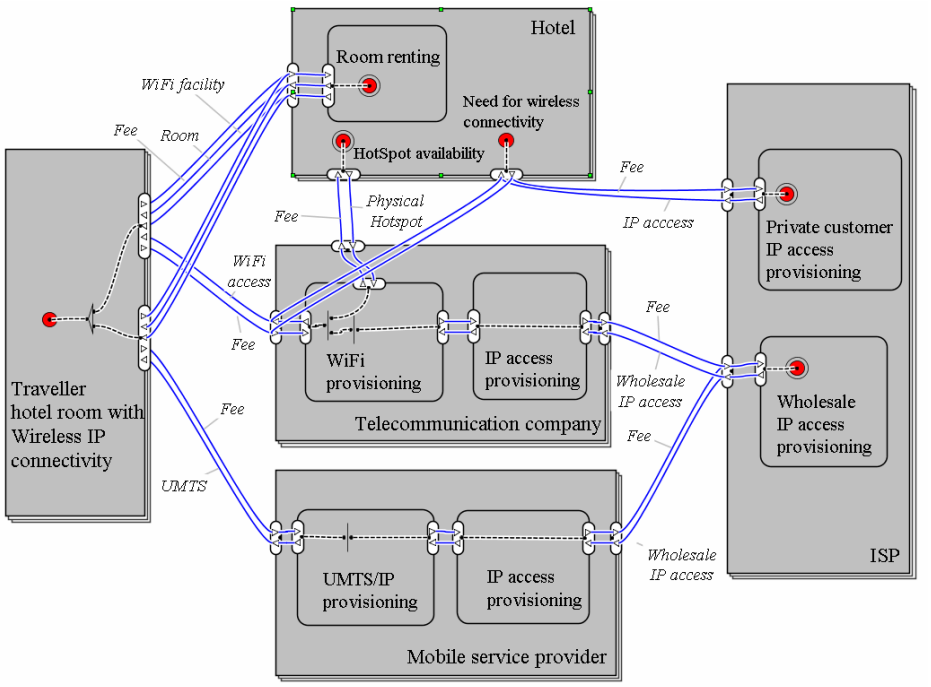

Figure 1. Initial value-based business model for the traveling salesman.

The model can be best be explained by showing how the consumer need can be satisfied and what value activities take place. We distinguish between two scenarios: (i) the value activities related to the traveler's need and (ii) the value activities related to service offerings of the hotel. During the process of value-based modeling, the main question is: "*what* is offered to someone and *what* is received in return". It is important to consider that all the actors involved in the mentioned scenarios should have benefits to ensure the continuity of the service offering.

In the first scenario, the left bullet eye denotes a start stimulus or consumer need, which is the need for wireless Internet connectivity. The triangle represents two alternatives that the traveler has in order to satisfy his needs: (1) by exchanging values with a hotel and a telecommunication company, and (2) by exchanging values with a mobile service provider. Considering the mentioned two alternatives, the following value exchanges are visualized.

The first alternative shows that the traveler chooses for a hotel that offers a room with hotspot facility. As we indicated, the hotel offers the ICT service jointly with the

telecommunication company, which operates the hotspot facility. The physical Internet access has to be obtained from an Internet Service Provider (ISP). The bullet eye in circle represents the end stimulus of the value exchange. It appears at the ISP and at the hotel; since the hotel satisfies the requirement of room renting with wireless hotstpot facility and the ISP satisfies the need of physical connectivity to the Internet.

Value exchanges happen between the actors involved. Considering the first alternative, an important detail is the value exchange between the telecommunication company and the hotel. In our specific case the telecommunication company pays for the hotel in order to place a hotspot. For the telecommunication company the hotel acts as one of its sales channels for distributing its services and, thus, for increasing the number of its subscribers. Another possibility might be that the hotel pays for the operator since the offered service increases the attractiveness of the hotel and therefore the number of its customers. Which one to choose is a matter of negotiation and market considerations.

The second alternative implies that the traveler obtains the access via UMTS and pays his mobile operator a fee for this. The mobile operator has to obtain the physical Internet access, similarly from an Internet Service Provider (ISP). The end stimulus appears at the ISP representing the last element of the chain of the value-exchange.

In the second scenario the need is occurred in the hotel itself: a need for Internet access, as it is noted by the start stimulus. The hotel may need wireless Internet access for its own business processes. Therefore, the hotel is the consumer of the service as it is depicted on Figure 1. As a result, the hotel may play a role in service *supply* (acting as a market channel and offering a physical place to host the hotspot), as well as in service *consumption*. Obviously, the hotel also has the possibility to achieve its desired wireless network connection via other alternatives, namely by obtaining the access directly from am ISP. Again, we restrict our model to these two mentioned possibilities although we are aware of that in real life more alternatives do exist.

5 Business-ICT Alignment

5.1 Analysis of the Alignment Problem

The problem of business-ICT alignment is in the difficulty of matching needs and requirements of customers over certain ICT services with the offered ICT services of suppliers. Our aim is to provide clearly determined factors that can characterize the alignment in the ICT domain and provide guidelines to achieve the most optimal one.

To do so, we modeled a business scenario with respect to an ICT service, namely to the need of wireless connectivity to the Internet. The resulted value-based business model gave us guidelines to understand the distribution and exchange of value objects between actors. This also helped us to visualize how certain service needs could be satisfied with service offerings.

In the following, we first discuss what we understand under the problem of ICT-business alignment and then give further guidelines to resolve them. In our case study of the traveling salesman we deal with two mayor alignment scenarios. These are the:

- alignment problem between the end-customer's needs and requirements of wireless connectivity and the offered services available on the market;
- alignment problem between the potential service suppliers (the telecommunication company, the ISP) and the hotel with respect to the offered ICT service (the wireless connectivity).

The first alignment problem represents the alignment problem between service suppliers and consumers. It is inherited from the appearing need of wireless connectivity to the Internet among business travelers, which can also be satisfied via several alternatives. The aspects of this alignment problem are twofold. From the customer's perspective it is central to understand what reasons might influence his decision. From the supplier's perspective the questions raised are (i) what reasons might lead to offer the service, (ii) why this new service offering might be successful on the market and (iii) how the service is meant to be a profitable one.

The second mentioned alignment problem has more complex aspects to reflect on. The hotel participates *both* in supplying and consuming an ICT service. This implies that its investment might be influenced by both the needs and potential benefits. Providing guidelines to satisfy both aspects support the answer for this alignment problem. In our model the hotel has more possibilities to satisfy its own needs, as we also discussed in section 4. Focusing on its offered ICT service for wireless connectivity, we examine the cooperation between a telecommunication company and the hotel at the first place. However, this service might be also maintained using other alternatives, namely using wireless routers combined with the provided Internet connectivity by the ISP. This existing alternative indicates the problem of this alignment scenario.

5.2 Finding a Suitable Tool for Reasoning over Successful Alignment

To reason over the alignment we use the *e*^{3}*-value* methodology to get a more detailed picture over the distribution and exchange of value objects. Rather than providing a

precise answer for suppliers over the profitability, sufficiency of the benefits of their value offerings, this technique helps to discover and to reason about factors that might influence them. Moreover, this technique is not suitable for reason over the quality of the exchanged value objects, namely of the requested and offered services. For customers it only shows the potential alternatives to satisfy their needs without validating them. Also, the *e³-value* methodology assumes the shared knowledge of common understanding of services, which is often missing in the ICT domain. The offered services might be validated differently by customers due to its diverse interpretations. This difficulty which influences the alignment problem cannot be highlighted by this technique. However, it can be resolved with deeper and more detailed understanding of service offerings and service needs and their characteristics.

To step further in our analysis we combine the *e³-value* methodology with the so-called service ontology. It provides a more detailed description about the attributes of services. In addition, this ontology helps to understand the complexity of offered services by determining and describing their elements. The most relevant benefit of using the combination of these tools is to define profitable and meaningful service offerings for the suppliers by determining *service bundles*. To reason over a successful alignment between service needs and offerings it is necessary to combine these two mentioned techniques. The question is whether this combination is also sufficient for our purposes in the ICT domain.

The service ontology deals with *service elements* that result from our value-based business model. The parallelism between these two models can be interpreted in the following way. The *value activities* in the *e³-value* model correspond to *service elements* in the service ontology and the defined *value objects* result in *resources*. An optimal service bundle is generated by coupling more elementary services together which create profit as a whole for the service supplier with respect to the needs of its customers.

Our first alignment problem deals with matching needs and offerings of an ICT service. The existing ontology deals with service elements and their attributes in order to configure profitable bundles for suppliers. However, in this specific scenario to reason over the successful alignment between the end-customer's needs and the suppliers' offerings on the market, the costumer's perspective also plays an important role. The characteristics (e.g. quality and efficiency of the available services) that influence the successful alignment cannot be conceptualized with the existing ontology due to its nature. In addition, the service ontology does not provide the answer what reasons might lead the end-customer to choose the offered service. Moreover, it assumes the common understanding of service elements which is often not the case between customers and suppliers in the ICT domain.

In the second alignment problem the hotel plays the main role. It is interested in *both* supplying and consuming the ICT service. This problem has two interesting aspects to consider: (i) alignment problem between the potential needs of guests and the services of the hotel and (ii) alignment problem between the hotel as customer and its potential service suppliers.

The first aspect can be translated to a typical service bundling scenario. The hotel would like to provide extra services for its guests, and it considers alternatives to do its service bundling. The service ontology focuses on the benefits and requirements of the offered service bundling in which the hotel is interested, thus, this tool might generate feasible service bundles and suitable answer for this aspect of the alignment problem.

However, the second aspect deals with similar questions that we highlighted in the first alignment problem. The hotel as a customer would like to have wireless access to the Internet to satisfy its own needs. This aspect influences the bundles of its offered services. From one hand, the service ontology helps to reason over what service bundling might be beneficial for the hotel in order to increase its attractiveness. On the other hand, it should also to be useful in deciding upon the optimal bundling while the own needs and requirements are also taken into account. This factor cannot be conceptualized by the existing ontology.

Moreover, the technique does not give feedback over the additional benefits of the alternatives to the hotel. As one can conclude, the service offering of wireless connectivity might be more beneficial if it is done based upon the private IP access maintained by the ISP directly since it involves less elementary services, thus less additional suppliers involved. However the hotel chooses to satisfy the technical requirements for the wireless connectivity by the services of the telecommunication company. This decision of the chosen alternative is influenced by the different valuation of the alternatives. The additional benefits and advantages that the hotel might gain by the co-operation with the telecommunication company influence the valuation of the offered service thus its service bundling. Unfortunately, this factor cannot be conceptualized by the service ontology.

Besides the drawbacks of the existing terminology, it also faces with shortcomings considering the service bundling. It assumes the common interpretation of specific service elements between stakeholders. However, it is often the case that the failure of the offered service is caused by its wrong interpretation by potential customers. This possible difficulty of the bundling cannot be highlighted by this technique as well.

6 Concluson and Outlook

In this paper we present a case study and its value-based business model to address our desired research questions. For reasoning over successful business-ICT alignment the extension of the *e³-value* model is necessary. Therefore, we combine this technique with the so-called *service ontology*.

Based upon our first results, we can learn from our study that monitoring and analyzing value activities and exchanges between the (chain of) suppliers and their customers in the ICT domain are possible with our existing techniques and terminologies. The *e³-value* methodology serves our main purposes since it was designed to give useful feedback on the distribution of the economic value. The service ontology provides meaningful information over what beneficial bundles of value objects can be generated, thus what service offerings might be beneficial from the supplier's perspective. By observing value-exchanges and value activities combined with generating service bundles, we hope to show a reasoning method over efficient alignment scenarios between ICT service offerings and ICT service needs. It may also open up benefits of the networked business-ICT alignment by achieving cost-efficiency, improved productivity and better service quality.

As a first difficulty we conclude that this combination of techniques does not take fully the customer's perspective over a certain service into account. The main advantage is the provision of guidelines for suppliers to generate profitable service bundles. Yet, to reason about value-based alignment the customer's requirements and expectations should be taken into account since these characteristics influence his decision. Moreover, in the ICT domain we often deal with stakeholders that ate interested in *both* supplying and consuming a certain service. Therefore, the automated bundling of service offerings should take both of these aspects into account. Still, this combination of techniques gives us the framework, which can be developed further in order to focus on these issues.

A second potential problem is the different interpretation of services among customers and suppliers. The applied modeling techniques – *e³-value* ontology and the service ontology – assume explicitly the shared knowledge of common understanding of services. In the ICT domain, on the contrary, the exact definition and identification of services might result in number of complexities. Actors might not have a clear view and understanding upon the elementary services and their factors. Hence, the value objects that are the subjects of value activities between actors might not be clearly determined or might be misinterpreted. This might result in the lack of successful co-operation and dissatisfaction of customers' requirements.

A third difficulty of the alignment process lays in the complexity of the valuation of ICT services. As we discussed in section 4.1, ICT services are *economic valuable services*, thus, the determination of the economic value might be necessary to step further in the analysis and to support more the reasoning over a successful value-based business-ICT alignment scenario. However, a stakeholder may value an object differently, since the demands and the requirements of an ICT service might have different origins and characteristics. Different valuation of value objects influences the choice between alternatives of value activities. The proper modeling tool, which helps to reason over successful alignment, therefore should take this aspect into account.

The combination of our existing modeling techniques demonstrates only value exchanges and alternatives for satisfying service needs and requirements. Furthermore, it gives guidelines to generate service bundles for suppliers but does not distinguish between different value interpretations and validations of the alternatives. To use this tool as a successful candidate to reason over value-based alignment, further modifications are needed.

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