

RZ 3236 (# 93282) 06/12/00
Computer Science/Mathematics 12 pages

Dynamic Outsourcing of Services

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Dynamic Outsourcing of Services

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Abstract

The concept of outsourcing has its roots in the manufacturing industry where products are often assembled using standardised components produced by partnering companies. However, driven by information technology, services today are also subject to standardisation and subsequently more and more examples of service outsourcing can be observed in practice.

The outsourcing process in general requires to describe service offers and service requests, to match providers and consumers, to negotiate the terms and conditions of the contract, and finally to setup the provisioning of the service (triggering execution, billing etc.). These coordination steps can be performed in an electronic market, which allows the exploitation of both, electronic market characteristics such as low transaction cost, and generic service characteristics such as intangibility, to increase the efficiency of the outsourcing process.

But the emergence of electronic markets for services also enables a change to the outsourcing process itself. The final state of the traditional outsourcing process is an outsourcing relationship involving one consumer and one provider organisation that covers a certain number of service provisions. In contrast to this, dynamic outsourcing is an ongoing process that involves a set of provider organisations competing in an electronic market for services. Whenever a service needs to be performed, the consumer organisation dynamically selects the 'best' provider for this specific service request.

This dynamic relationship requires strong support for automation in the coordination process and a high degree of interoperability among the providers and consumers. Many standards have been suggested to address interoperability in electronic markets. These standards can be classified in semantic standards for certain industries and in meta-standards, which define the general nature of interfaces or messages. An analysis of the latter shows, that these standards mainly focus on the knowledge phase of electronic markets, lacking support for processes in the intention and agreement phase as well as the service management issues in the settlement phase.

1. Introduction

Speed and distribution characterise many aspects of today's business and organisation undertaking. Organisations are challenged to bring ideas and concepts to the market in an increasing pace. Companies distributed by space, time, and capability co-operate to deliver products and solutions whenever a potential demand or opportunity is discovered in the global market. The trends for virtual enterprises and increasing global networking are real and will accelerate.

Dynamic outsourcing of services is one way to coordinate the relationships between companies, which form these virtual enterprises.

Section 2 of this paper will illustrate the evolutionary path towards the concept of dynamic outsourcing. Two critical enablers for dynamic outsourcing can be identified: interoperability and automation. Section 3 will therefore briefly characterise and evaluate emerging standards for electronic commerce interoperability regarding their use for the dynamic outsourcing process. Abstracting from technological issues, Section 4 then discusses the general applicability of the dynamic outsourcing process. Finally Section 5 envisions further developments that could occur in the future, if dynamic outsourcing and electronic service markets became ubiquitous.

2. Towards dynamic outsourcing

This section ploughs an evolutionary path from an introduction to the traditional understanding of outsourcing, via a definition of services and electronic markets for services, to the blending of all concepts into the process of dynamic service outsourcing. To further illustrate dynamic service outsourcing, this section closes with a practical scenario.

2.1. Traditional outsourcing

Current research [1] indicates that the global outsourcing market will exceed \$121 billion by the year 2000 and shows no signs of slowing. At an annual rate increase of 20% to 30% a year, outsourcing is a leading business trend.

The term 'outsourcing' is an artificial word created by compressing the expression 'outside resource using'. Traditional literature defines outsourcing as the process of transferring the performance of a service traditionally handled by internal resources to an external provider [2]. Using this definition, outsourcing is differentiated from other interactions with external providers such as procurement or projects by the fact that in procurement scenarios the service was initially not performed internally and that projects have a defined termination.

Traditional outsourcing involves a consumer organisation and a provider organisation. The provider organisation usually relies on specialisation and economies of scale to provide better and cheaper services than the internal resources available to the consumer organisation.

For the consumer organisation, reasons to outsource comprise for instance [3]:

- Focusing on core competencies
- Freeing resources
- Improving performance
- Saving operating costs
- Sharing risk
- Lack of internal skills and resources

In the beginning of this section, outsourcing was defined as a process. Fundamental steps in this process are an internal analysis and evaluation, a selection of the provider including a negotiation of the terms and conditions of the contract, and finally the implementation and management of the provisioning of the service (see for example [4]).

A lot of research has been and is still being carried out regarding the 'make or buy' decision, which is core to the first phase, the internal analysis. This decision is complex and involves fundamental considerations about the optimal boundaries of a firm. Using for instance transaction cost theory, the boundary between markets and organisations is determined so as to minimise transaction cost [5].

With the rise of the Internet as open network infrastructure even more options for the organisation of a firm and the coordination of value chains have evolved. The boundaries of a firm are blurring. Value webs are new forms of fluid and flexible organisations [6] where from an outsourcing point of view, ‘make or buy’ is not the fundamental issue. Value webs buy existing products or services to provide unique offerings tailored to specific demands (that might be even of temporary nature) where no significant investment for specialisation etc. is needed. The focus for value webs therefore shifted to the decision ‘where to buy?’ A development, which is reflected in this paper, as the focus is on the subsequent process steps following the principal outsourcing decision.

The object of outsourcing can vary significantly. Organisations can decide to outsource whole organisational entities such as the IT department as well as organisational functions on a lower scale of granularity such as IT operations (see Figure 1 in the next section). But as outsourcing is a relational concept, which involves a consumer and a provider organisation, the options are also dependent on what providers are willing to offer.

Outsourcing providers are typically present in areas with high standardisation and low specification where disadvantages of incompatibility are rare. Standardisation enforces the compliance of products or services to a specification and thereby enables outsourcing providers to benefit from economies of scale as well as low setup and customisation costs.

Standardisation of industrial product components already stimulated cross-organisational supply chains in manufacturing industries such as cars or electronics where outsourcing of components today is prevalent. What is the situation for services?

2.2. Services as the object of outsourcing

Services in general are characterised by their intangible (missing physical characteristics) interactive (the consumer has to provide presence, goods or information for the service to be performed) nature¹. Services are implemented by processes, which again consist of activities that contribute to the service. Examples for services are real estate management, recruiting or transportation.

Compared to goods or product components, services bear a higher purchasing risk. First of all, some services do not create a direct consumer benefit but a derived consumer benefit. An example is an insurance coverage. Although the service may never be invoked, the option to start the claim process constitutes already a consumer benefit. Another risk is related to the fact that it is often not possible to assess the quality a service before the actual consumption, which is not the case for instance for screws or tires. In addition, services are much more complex to describe as industrial components because the description has to include quality of service aspects, runtime interaction interfaces etc.

Looking at services, a similar trend towards standardisation can be seen, initiated primarily by software technology. The Internet is the main driver for standardisation in the area of networking and application protocols (IP, TCP/IP, FTP, HTTP, XML etc.). This development can be summarised as a first standardisation wave, which focuses on the IT infrastructure.

The next migration currently in process is targeted at applications. With maturity, software industries are consolidating and in many areas only a small number of remaining vendors is dominating the market. Today a majority of business organisations is using the same breed of application platforms (ERP applications such as SAP and BAAN, databases such as IBM’s DB2 and Oracle) on a small range of operating systems. It is therefore technically and due to the size of the market also economically feasible for providers to host and for consumers to outsource these applications² [7].

How is this related to the third wave, the standardisation of services? Especially the ERP application systems with reference models, templates, patterns etc. tend to define the processes they support. To minimise customisation efforts, many companies reengineer their processes according to the application platform chosen and therefore standardise them [8],[9]. On the basis of this standardisation, processes and even single task elements of these processes can be outsourced and procured as services (see Figure 1).

¹ See the seminar papers of Benita Brockdorff or Ulrich Schilling for further definitions.

² A major concern still is confidentiality. Leaving mission-critical data on systems out of internal control is currently ‘unthinkable’ for many companies.

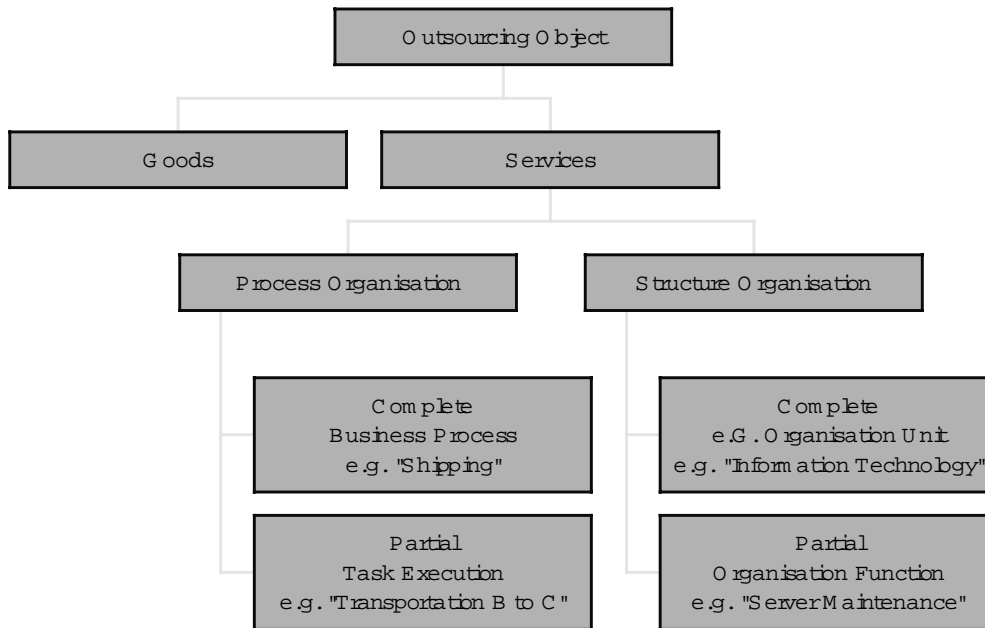


Figure 1: Scope of outsourcing

Compared to goods (with the exception of digital goods such as MP3 files) the intangible nature of services favours electronic coordination mechanisms [10]. For many types of services it is not necessary for providers and consumers to interact physically, to actually move something to the provider organisation etc. In the example of translation services, all messages can be exchanged with electronic means. This in turn allows to keep setup and switching costs low. For these services the interaction between consumer and provider can be supported completely using electronic media. The interactive nature of services is also exploitable in an electronic medium in the way that electronic communication is generally cheap and the connectivity already pervasive in today's economy.

2.3. Electronic service markets

An electronic market implements a medium, based on information and communication technology, for the exchange of goods and services between agents coordinated by supply and demand forces [11]. An analysis of electronic markets compared to traditional markets reveals distinct characteristics such as higher transparency and lower transaction cost [12].

Current electronic markets are mainly used to exchange commodities such as books, CDs or network bandwidth. But the benefits of electronic markets can also be used to increase the efficiency of market coordination for services. If, for example, the search for providers of services is executed in an electronic market, the costs associated to this search are generally low or even zero, whereas the number of potential providers can be very high. This is due to the fact that electronic markets, in principle, are not limited to national or geographic boundaries.

Whereas the object of exchange, services, is different to, for example, markets for production goods, the principal market mechanisms are the same. An electronic service market, as any other market, should ideally support the generic transaction phases knowledge, intention, agreement, and settlement [11]. Examples for service markets operating today are MySAP.com or the Ariba network. These markets already allow the performance of service outsourcing with market coordination using an electronic medium.

2.4. Dynamic outsourcing

Whereas Section 2.2 discussed the extension of the scope of outsourcing to services, dynamic outsourcing is not about another extension of the scope, it's about a change to the process.

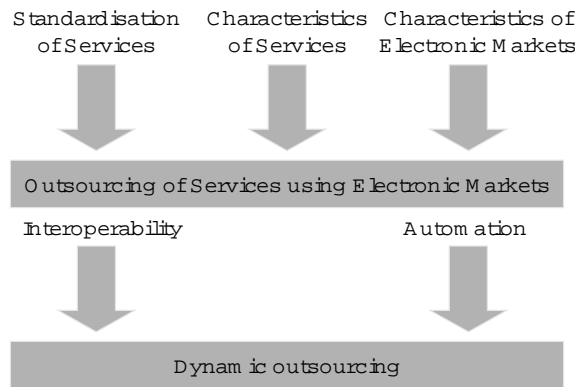


Figure 2: Towards dynamic outsourcing

Dynamic outsourcing builds on the foundation of traditional outsourcing of services through electronic markets. The final state of the traditional outsourcing process is an outsourcing relationship (usually formalised in a contract) with one consumer and one provider organisation. In contrast to this, dynamic outsourcing is an ongoing process that involves a set of provider organisations competing in an electronic market. At the moment of the service request, the consumer organisation chooses one provider among the open set of providers (providers can dynamically join) to perform the service.

Dynamic outsourcing continues until, for example, either the service is not needed any more or some other external factor with impacts on the overall outsourcing strategy changes. The relationship between one consumer and one provider organisation in dynamic outsourcing scenarios is characterised by its short-term nature and a very loose coupling as illustrated in Figure 3.

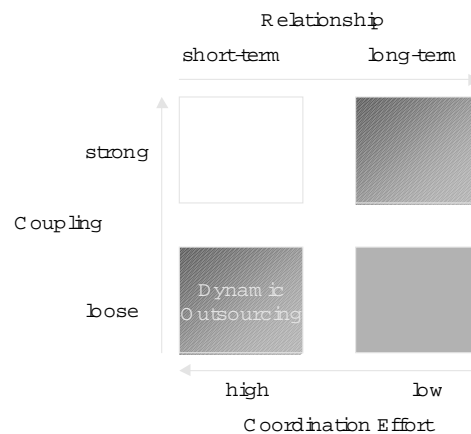


Figure 3: Dynamic outsourcing properties

Dynamic outsourcing is often contrasted to strategic outsourcing. Whereas dynamic outsourcing is focusing on competitive pressure in order to achieve efficient prices and flexibility (see Section 4) the goals of outsourcing with a strategic intent are, for example, the development of new business capabilities, the exploitation of internal assets externally or the creation of new market channels [13]. This process leads to strategic partnerships with outsourcing providers that often involve the transfer of assets (personnel, IT infrastructure etc.) either to the provider organisation or to a jointly created new company. However, outsourcing relationships driven by strategic intent can, in general, be of short-term as well as of long-term nature.

It is important to mention that there is also no necessity to link loose coupling with short-term contracts. From a business perspective contracting is on a different level and subject to other optimisations. It could be a rational choice for a consumer to enter long-term agreements although providers could be switched easily (see below). Loose coupling is therefore a necessary, but not a sufficient condition for dynamic outsourcing.

Several preconditions have to be fulfilled in order for dynamic outsourcing to be an efficient choice for both consumer as well as provider organisations. The most important building block for dynamic outsourcing

is a critical mass of electronic service market participants. This requirement leads to a discussion of incentives for participation.

In general, market-based allocation requires a higher coordination effort than hierarchical coordination [14]. To perform dynamic outsourcing from a consumer side, the additional costs associated with market coordination have to be lower than the benefit achieved by efficient market prices. The overall return of market-based coordination also has to be higher than the return of an alternative long-term contract with a single provider covering several service provisions – a scenario which gives the consumer organisation a lot of negotiation power to lower the price.

The next precondition affects both sides in the outsourcing relation. Loose coupling requires low asset specificity (small investments to support specific transactions). Bilateral dependencies build up as asset specificity deepens [15]. With low specificity the cost of switching providers can be close to zero. But if switching costs are low, what is the incentive for providers to participate in such a market, where they can be exchanged easily and competition is fierce? One answer is ‘network externalities.’ The overall utility of a market, or a network of consumers and providers, as well as the utility for each participant, increases as the number of participants of the market increases [16]. To relate this argument more to the situation of a provider in a service market: in the same way that consumers have access to a larger variety of providers, providers of services enjoy a much larger demand community.

In summary, low coordination cost and low partner-specific investment costs are necessary to make dynamic outsourcing economically feasible. In addition to the usage of electronic markets to lower coordination cost, two other elements can be used to suit these requirements: a high degree of task automation and market interoperability standards. To assess the state of the art of automation support for dynamic outsourcing of services is outside the scope of this paper (for a general discussion see for example [17] or [18]).

Therefore the current situation of interoperability for electronic service markets is reviewed in Section 3. But before this view on the pre-conditions of dynamic outsourcing is presented, a practical scenario will illustrate the process of dynamic service outsourcing in more detail.

2.5. Scenario

Dynamic outsourcing could be applied in the following scenario. Company A needs from time to time document translations from German to English and from German to French. The documents vary from simple correspondence to manuals for new software products. Company A already analysed that it has not the resources and the desire to recruit translators in order to build up an internal translation unit. Companies X, Y and Z provide translation services, though varying in quality and sometimes with restrictions regarding the time of completion and the availability of translators with knowledge of the business context.

Using the traditional outsourcing approach, Company A would evaluate all provider companies and award one with the contract for all translation services, specifying for instance a certain quantity of translations (e.g. lines times complexity factor), or alternative providers for different types of documents. If a document needs to be translated, it is simply forwarded to the selected outsourcing company until the contract expires.

Using the dynamic outsourcing approach, companies X, Y and Z all participate in an electronic market for translation services. Company A, the consumer organisation, now posts a new request for translation services to the market, whenever a document needs to be translated. Company A defines constraints and provides details about the document. Companies X, Y and Z are notified about the new request and have the option to bid for the translation service. On the basis of an evaluation of the bids received (time to complete, quality of service, price etc.), Company A decides to contract Company Z to provide the translation service for this single document. Finally the document is transferred to Company Z for translation.

Arguments against and in favour of these two outsourcing scenarios are discussed to some extent in Section 4.

3. Interoperability standards

In this section, standards addressing the interoperability of consumers and providers of services in electronic markets are categorised on the basis of the media reference model [19].

To be more precise, standards covered in this section are meta-standards that address interoperability in electronic service markets defining for example technical interfaces or message structures, not the semantics,

the content, of services in specific industries itself. The reason that standards, for example, for procurement or transportation are not discussed, although they are of similar importance for dynamic outsourcing, is simply a matter of scope. With the rise of XML, standards for basically all service industries (e.g. the HR XML Consortium which defines standards for candidate profiles, job postings and resumes or OFX for financial services) are emerging rapidly and can therefore not be investigated within the limited scope of this paper.

Hence, of interest for this section are for instance standards that define how to describe or discover services. If, for example, such a standard exists for service descriptions, a provider can enter the market by describing its service according to the interoperability standard and potentially an additional semantic or transaction framework, which guarantees, that the service description will be discovered and is 'readable' for consumers. It is not necessary for the provider to customise the service description to each potential consumer. Respectively, the consumer can post requests without knowledge of all potential providers as the standard guarantees compliance of its search constraint to the service descriptions of the providers. Requests could even be posted to several markets in parallel (if applicable) or to several different service domains, using the same standard.

3.1. eCo Framework

The eCo working group (see [20] for the following) was established by CommerceNet in 1998 with the goal to develop concepts for interoperable eCommerce.

3.1.1. eCo in a nutshell

eCo defines a framework, which allows exposing a set of meta-data, so to speak the interface of an eCommerce system, which can be then queried by potential partners. In addition to describing meta-data, the eCo framework defines interfaces for accessing this data.

Several architecture layers are defined. The hierarchy is as follows: '*networks* contain *markets* where *businesses* provide and use *services* which conduct *interactions* that exchange *documents* containing *information items*'. Any one business may, for example, participate in multiple markets. Each layer contains specifications, whose attributes are stored in XML-based registries. These registries allow, for example, providers to register information about their services and service policies and consumers to register themselves with their preferences and profiles. To perform a query, published interfaces such as 'ServiceGetProperties' are defined, which return in this example a 'ServicePropertiesSheet', which contains 'ServicePreConditions'.

In addition to this instance level, eCo also defines type registries. A type registry might define a service type 'GetTranslation' which then could have specific instances such as 'GetTranslationFromX'. Using type registries it is possible to determine the equivalency of two types.

Services in the eCo world are defined as interfaces to business processes and represented by XML documents. On the highest level, businesses interact by using services of each other within the context of some business process. The interaction layer describes a flow of interactions that might take place when a service is invoked. During each interaction the messages that are exchanged are described as types of documents or information needed during that interaction.

If a company provides, for example, a specification for the services layer, it is eCo service-layer compliant and can interoperate with other service-layer compliant companies. Compliance requires that all published queries work correctly. Technology vendors can use this architecture to build eCo compliant directories or agents.

3.1.2. Evaluation

eCo's framework is designed to solve one critical issue - understanding the basic components of another company's eCommerce system. The standard defines the necessary architecture and protocol of mutual discovery and therefore establishes a foundation for the usage of other semantic standards. eCo is not aimed at standardising the internal eCommerce systems of a company, but, assuming that the interface is much more stable, the means to interoperate.

The concept of compliance is very helpful to achieve low setup and switching cost. Prospective service providers using the registries and evaluating the meta-data can learn in a generic way all that is required to interoperate with a specific consumer without proprietary integration efforts. Furthermore, the eCo frame-

work has a notion of services and markets, which is very close to the definitions used in this paper. Regarding the scope, eCo is situated in the knowledge phase of an electronic market. But the information available through eCo interfaces, especially in the service and interaction layer, will also be used in the settlement phase to actually invoke services.

3.2. E-Speak

E-Speak developed by Hewlett Packard (see [21] for the following) is a middleware infrastructure for the creation, management and access of Internet-based services. Though currently not an open standard, HP plans to hand over the E-Speak specification to a non-profit organisation in the near future.

3.2.1. E-Speak in a nutshell

Services in the E-Speak framework are computing devices, data content or applications. They are all connected by a core runtime engine and APIs, which provide basic infrastructure capabilities such as messaging, naming, matching and monitoring.

E-Speak defines a hierarchical service structure. Services of higher complexity can be build using commercially available pre-built components of other providers. These components may be part of an E-Speak solution framework. A corresponding e-Speak component web-shop is currently under development.

Service providers use an attribute-based specification with name-value pairs to register a service as a resource. The core logical machine captures meta-data for all services that register with it. To enable dynamic interactions, this meta-data can be queried by other services. Resource meta-data is stored in a repository. A vocabulary defines the set of allowable attributes and types. Vocabularies are created using a meta-language and can be dynamically discovered like any other resource.

A search recipe specifies what resources a client is looking for, how the lookup should be performed and how multiple matches should be handled based on constraints. The matching engine of the core vocabulary service matches resource and service descriptions with search recipes.

In one example HP demonstrated E-Speak's ability to find translation services for converting e-mail from a foreign language to English and to negotiate the best price for that conversion.

3.2.2. Evaluation

The notion of services in the E-Speak framework is on a very technical level. Services in E-Speak deliver value electronically and are called synchronously. Hence, the focus of this framework is more on virtual applications than virtual enterprises and therefore on the transaction layer of electronic markets. But for these kind of services the framework is offering support covering all basic coordination functionality required in the phases of a market transaction.

E-Speak, comparably to eCo, is designed to be combined with semantic standards in order to achieve it's full capacity. These standards can be used, for example, to define the E-Speak vocabularies.

3.3. BizTalk

BizTalk, originally developed by Microsoft Corporation is now an open consortium, which defines information flows that move between business processes (see [22] for the following). The goal of the BizTalk framework is to define a way to use XML in a consistent way.

3.3.1. BizTalk in a nutshell

BizTalk tries to eliminate interoperability issues such as transport selection, calling conventions and data formats. The BizTalk framework consists of three parts: a technical specification for the usage of XML, a code set with a small number of pre-defined optional and mandatory tags, and the biztalk.org portal. The combination of all three elements is used to formalise the process of expressing business process interactions.

Business message documents are described by schemas, which list the elements and attributes that may appear in the message. The framework specifies a tag that allows for example a provider application to check whether the consumer who sent a request document uses XML that adheres to BizTalk. If this is the case, the provider application knows where to look up the document type. Finally, the optional routing tags allow an

application to easily determine the consumer's identity and the intended use or destination of the data contained in the document.

The portal serves as a centralised managed library that lets consumers and providers share information about schemas, documents and messages. To support this, the biztalk.org web-site provides automated submission facilities for (public or private) schemas, a validation process, and mechanisms for the dynamic detection of schemas.

3.3.2. Evaluation

The BizTalk organisation is not positioning BizTalk as a standard but as a framework – the standard is XML. The focus of BizTalk is on the knowledge phase. It supports providers and consumers with a standard platform to create a service market community. Overall, the scope of definitions provided by BizTalk is rather limited, although this ease of compliance might help it to achieve significant momentum. There is no specific consideration of the nature of services, just a general fuzzy notion of business processes. But the envisioned combination with the announced BizTalk server from Microsoft could eventually result in a more extended standard that also includes the discovery, binding, and execution of services in an automated way.

3.4. Summary

The evaluation of these standards can be summarised as follows: on the implementation layer standards are emerging especially for the knowledge phase and partly for the settlement phase. On the transaction layer E-Speak supports all phases but with a very limited approach. There is a general lack of standardisation efforts in the intention and agreement phase.

To standardise the interactions in the agreement phase it would be necessary to develop standards for electronic contracts and signatures (see for example [23]) and to structure the typical information exchange in the agreement process (counter-offers, rejections, inquiries..., see for example [24])

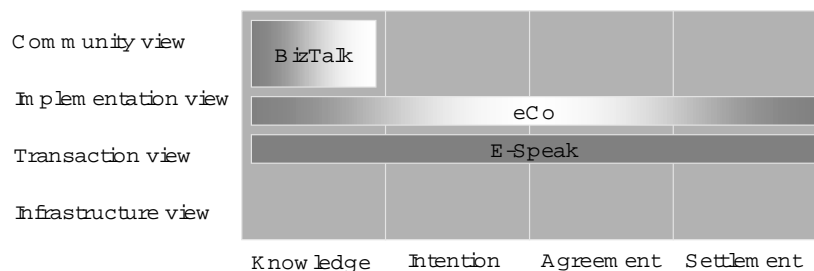


Figure 4: Scope of standards

Additionally, no standard organisation is currently addressing the service management aspects of the settlement phase. Management of services comprises monitoring and control. Parcel delivery providers such as Federal Express or UPS offer for example the monitoring of a service's performance. Consumers can track the current status and location of their parcels. A control operation in the sample scenario of this paper would for example be an operation to change the document during the translation because the consumer company detected an error in the original document. eCo's interaction layer and the billing services in e-Speak are first attempts to encompass these issues. From a different direction but also with potential effects on standardisation, a conceptual modelling approach for service management was suggested in [25].

4. Discussion

The analysis shows that the state of interoperability is still immature and therefore setting up and participating in dynamic outsourcing processes in practice today is in many cases for companies still not economically feasible. However, first prototypes of dynamic outsourcing are currently under construction. The CrossFlow project of the European Union [26] is, for example, implementing dynamic outsourcing based on electronic contracts and cross-organisational workflow systems for scenarios such as claims processing and parcel delivery.

Assuming that interoperability is less of an issue in the future and dynamic outsourcing becomes feasible - when should it be applied? In principle, dynamic outsourcing promises the following advantages:

- Effective prices for each instantiation of a service due to competitive pressure
- Flexibility through dynamic inclusion of new providers and consumers to the service market
- Better quality control through termination of a contract after each service invocation and re-evaluation of the provider.
- No disparities between capacities (supply and demand are matched dynamically)

But the decision of a consumer organisation to apply dynamic outsourcing also depends on other factors such as the specificity, frequency, complexity, uncertainty, and strategic importance of the transaction [27]. Every organisation has a choice of co-ordination mechanisms for the relationships in its value chain that can vary from strong hierarchical coordination via flexible forms of participation and long-term contracts to spontaneous market coordination. And to find out the right choice might just be the secret of economic success.

5. Outlook

If in the future, electronic service markets, a high degree of automation, and interoperability standards were commonly established, this would not only enable the widespread application of dynamic service outsourcing, but could also lead to the autonomous formation of new complex service structures. Very much in the same way as in the biological evolution, where larger entities were build from simple components (Cambrian explosion), self-describing, -connecting and -interacting services could build autonomously and spontaneously structures of higher complexity. These structure eventually could result in the creation of a digital service economy and society, which adapts and evolves without human intervention, and reacts dynamically to emerging needs and changing environment factors.

Glossary

- **Outsourcing**
The process of transferring the performance of a service traditionally handled by internal resources to an external provider, including the subsequent usage of this service.
- **Dynamic outsourcing**
The ongoing process of market-based provider selection for every invocation of a service.
- **Services**
Business processes creating benefits for consumers, generally characterised by their intangible interactive nature.
- **Electronic service markets**
A medium for the exchange of services between consumer and provider organisations coordinated by supply and demand forces.
- **Service Management**
The execution of monitoring and control operations during the performance of a service.
- **Interoperability standard**
A standard defining the technical structure of interfaces messages and protocols for electronic commerce interactions between organisations.
- **Semantic standard**
A standard defining the content structures of interfaces, messages and interaction protocols from a business point of view.

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