Hybrid Cloud Intermediaries
Facilitating Cloud Sourcing for Small and Medium-sized Enterprises

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Abstract: Whilst "the cloud" is pervasively advertised as a silver bullet for many IT-related challenges of small and medium-sized enterprises (SMEs) because it can potentially lead to many attractive benefits, many SMEs refrain from using cloud services because of high upfront costs for building the appropriate knowledge in the enterprise, for searching and screening of possible cloud service providers (CSPs), and for mastering the intricate legal issues related to outsourcing sensitive data. In this paper, we present *hybrid cloud intermediaries*, a concept that can address many of the prevailing issues. We describe the concept in detail and show conceivable variants, including a comprehensive cross-perspective consolidated model of cloud intermediary value-creation. Subsequently, we analyze the benefits of such a hybrid cloud intermediary for SMEs and suggest suitable governance structures based on the cooperative paradigm. The resulting entity is concisely called a *coop cloud*.

1 INTRODUCTION

"The cloud" is widely hailed as a silver bullet for many IT-related troubles of small and medium-sized enterprises (SMEs). Apart from the principal argument of notable cost savings, the promised benefits include access to flexible pricing and payment models, reduced administrative overhead, and access to state-of-the-art technology. Nevertheless, many SMEs refrain from using cloud services because of high upfront costs for building the appropriate knowledge in the enterprise, for searching and screening of possible cloud service providers (CSPs), and for mastering the intricate legal issues related to outsourcing sensitive data (Haselmann and Vossen, 2011; Vossen et al., 2012; Haselmann, 2012).

In this paper, we present the notion of a *hybrid cloud intermediary* that can address many of the prevailing issues. We do this by first providing appropriate theoretical background and an overview of related work in Section 2. Besides general cloud fundamentals, this includes a motivation of the particular problems SMEs face in contrast to larger enterprises, an overview of previous work on intermediaries in electronic markets ("cybermediaries") as well as an overview of the cooperative paradigm, which we will apply later on. Section 3 then introduces the notion of cloud intermediaries and analyzes their prominent traits. Subsequently, Section 4 provides a detailed view of the benefits a cloud intermediary can offer as well as a detailed characterization of a special intermediary variant. Turning from a market structure perspective to a governance perspective, Section 5 suggests a possible organizational form for a cloud intermediary based on the cooperative paradigm. We discuss our results and existing limitations in Section 6 and conclude in Section 7.

2 THEORETICAL BACKGROUND & RELATED WORK

2.1 Cloud Sourcing

The term "cloud computing" is widely used to describe a diffuse field of using IT resources via the Internet. The interpretations of the term range from the strict sense that designates only processing power ("compute") to the lenient interpretation that includes basically any remote procedure or service call. As a first step to rectify this imprecision, we provide a concise definition based on the definition by the US NIST[1] (Mell and Grance, 2011):

[1]National Institute for Standards and Technology

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> *Cloud sourcing* is the utilization of IT capabilities from a *cloud service provider* (CSP) based on the cloud paradigm. The *cloud paradigm* implies five characteristics:[2] resource pooling, rapid elasticity, on-demand self-service, broad network access, and measured service.

NIST defines three service models: Software-, Platform- and Infrastructure-as-a-Service, abbreviated as SaaS, PaaS and IaaS, respectively. The different service models represent different types of services and, in a sense, different levels of abstraction from the underlying physical IT infrastructure.

2.2 The Particular Situation of SMEs

SMEs are in a situation that is considerably different from that of large companies, due to several characteristics. Important traits in this context are the frequent lack of an IT strategy, limited financial resources, limited information skills, and often the presence of a solitary decision maker, i. e., the owner (Ballantine et al., 1998; Chen et al., 2003).

The benefits of cloud services for SMEs are rather similar to those for any other type of company (Armbrust et al., 2010; Velte et al., 2009). However, they are more pronounced for SMEs in some respects because of their characteristic features (Haselmann and Vossen, 2011). The main argument for cloud sourcing usually is that it cuts costs in the enterprise because expenditures for hardware, maintenance, and human resources can be reduced and at the same time converted into smaller payments distributed over the entire usage period (e. g., Altaf and Schuff, 2010; Armbrust et al., 2010; Rittinghouse and Ransome, 2009; Velte et al., 2009). Both effects are very desirable for SMEs, which are typically looking for ways to cut their IT spending. As a side-effect, the pay-per-use notion allows SMEs access to software or infrastructure that would otherwise be too expensive to purchase. Additional benefits of cloud sourcing include access to professionally operated data centers (Dimopoulos et al., 2004; Mather et al., 2009; Patnayakuni and Seth, 2001), elasticity and short-term contracts (Mell and Grance, 2011), i. e., additional flexibility for SMEs (Altaf and Schuff, 2010).

Notwithstanding those benefits, SMEs also face the downsides of the cloud approach as detailed above. Compared to large companies, they do not possess adequate means to address these concerns due to their small sizes. Specifically, legal aspects and trust concerns of cloud sourcing contracts cannot be adequately investigated by SMEs. On the one hand, this concerns data protection and data security issues; on the other hand, this stems from uncertainties regarding the legal situation surrounding a cloud sourcing. SMEs usually do not have enough staff to investigate new technologies, either. In conclusion, cloud services are a very attractive IT outsourcing approach for SMEs, but widespread adoption is hindered by the high required upfront effort and serious concerns of the enterprises.

[2]For an in-depth discussion of these characteristics see Mell and Grance (2011) and Haselmann (2012).

2.3 Cybermediaries

In general, an *intermediary* is a third party that facilitates economic transactions between two other parties. Relevant literature provides an overwhelming number of terms to denote different varieties of intermediaries; Howells (2006) provides a framework to organize the various facets of the term. In this paper, such a fine-grained differentiation is not required. Instead, we stick to the core idea of an intermediary as a middleman and facilitator of transactions. If an intermediary operates in an electronic market and, thus, is heavily relying on information and communication technology (ICT) for its business, it is also referred to as a *cybermediary* (Sarkar et al., 1995, 1998).

In principle, an intermediary provides value by arbitrating between two or more other parties. This position empowers it to reduce the complexity of the relationship between buyers and sellers, in this context cloud users and cloud service providers (CSPs), and to have all relevant information available for the interacting parties (Giaglis et al., 2002; Bakos, 1998). In effect, an intermediary can bundle supply and demand, match buyers and sellers, provide trust by reducing uncertainty, create new service bundles from different suppliers, appropriate collective goods, and – to some extend – mitigate the effects of moral hazard and adverse selection (Picot et al., 2008; Mahnke et al., 2008; Howells, 2006; Anderson et al., 2002; Spulber, 1999).

An important task of intermediaries is the collecting, editing and providing of reliable information. Thus, they can act as catalysts for interactions and transactions between users and CSPs (Howells, 2006; Giaglis et al., 2002). As a consequence, intermediaries can act as “change agents” (Howells, 2006), accelerating decision processes in partner companies and facilitating the use of novel technologies especially for SMEs that would otherwise not be able to assess all alternatives fully (Haselmann and Lipsky, 2012).

Building on the business model concept by Osterwalder and Pigneur (2010), Rensmann (2012b,c) has developed a generic, consolidated, cross-perspective model of cybermediary value-creation that allows to specify a cybermediary based on the following characteristics: its core value proposition, together with the

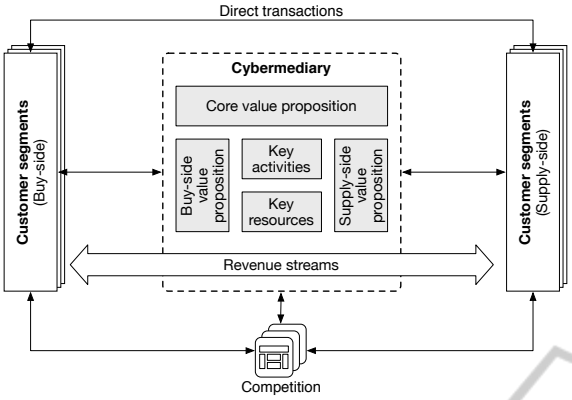


Figure 1: A cross-perspective consolidated model of cybermediary value-creation, showing the relevant characteristics of a cybermediary and its environment (based on Rensmann, 2012a).

specific buy-side and supply-side value propositions; the key value creating activities of the cybermediary, which are based on the required key resources; and relevant revenue streams. In addition, the market environment needs to be specified by detailing the customer segments on both the supply and buy side as well as describing relevant competitors. The resulting model is shown in Figure 1. We will adapt this model in Section 4.2 to specify a prototypical buy-side cloud intermediary.

The application of the intermediary idea to the cloud domain has hardly been investigated at all. Although there are many real-world examples of cloud intermediaries, e. g., business consultants that focus on cloud services, most studies regard intermediaries only as a subordinate phenomenon and not as the nexus of analysis (Howells, 2006); this holds even more for the cloud domain. Only Marston et al. (2011) already sketch a rough vision of applying the intermediary notion to the cloud domain, albeit without going into detail.

2.4 The Cooperative Paradigm

Following Haselmann and Lipsky (2012), a possible organizational form for an intermediary that internalizes information problems is the cooperative. We will introduce the reasons for this in a general way below and will further elaborate on this matter in Section 5.

A cooperative is a business organization owned and operated by a group of individuals (or companies) with a common goal and for their mutual benefit (MacPherson, 1995). Even though these individuals act rationally and self-seeking for their economic advantage, cooperative structures channel their actions so that these lead to a superior performance compared to an isolated approach. Although cooperatives are generally ascribed to old economic sectors such as agriculture or finance, a number of cooperatives has been founded in recent years in expanding, future-oriented industries such as IT (Theurl and Schweinsberg, 2004). Cooperatives can help realize synergies, compensate competitive disadvantages and allow the combination of decentralized knowledge without sacrificing any member's independence (Theurl and Meyer, 2005; Theurl, 2005a).

Cooperatives are characterized by a high degree of institutionalization and a standardized scope for action. The applicable "rules of the game" are defined by legislature and in the statutory regulations of a cooperative (Theurl, 2005a). These clear rules facilitate handling uncertainty and can thus foster credibility and trust among the members. This systemic trust is also created by the cooperative's special governance elements which are broken down into two main aspects: *mutualism* and *self-government*.

Mutualism means that the members assist each other through collective self-help. It implies the voluntary cooperation of members (voluntary entry into and exit out of the cooperative) without any help from outside. These structures are expatiated by the concept of membership that operationalizes another governance element, the consistent incentives. The special characteristic of a cooperative in comparison to other cooperation forms is the strategic alignment of all activities to the members' needs inside the cooperation. This finds its expression through the *MemberValue*, a special type of shareholder value. The MemberValue consists of the direct MemberValue (result of the members' function as service partners), the indirect MemberValue (result of the members' function as owners of the cooperative) and the sustainable MemberValue (result of the members' function as owners with focus on their status as investors). It thus includes both short-term and long-term value components (Theurl, 2005b). The creation of common values leads to mutual dependency among the members, i. e., they rely on each other. This fact and the establishment of a two-fold identity of the members as both customers and owners of the cooperative minimize uncertainty about a member's behavior leading to less opportunistic actions.

The second trait of cooperative governance is the self-government including self-responsibility of the members' actions with its democratic principles. An important particularity of a cooperative is that each member has exactly one vote[3] (*one-man-one-vote principle*). This favors smaller enterprises which are usually not in a position to negotiate with a larger business partner, such as a global CSP, due to size mis-

[3] In a few cases, the general meeting can decide on exceptions from this rule.

match. This is combined with the principle of parity, which guarantees that members cannot exploit the inner mutual dependency to their own advantage. Beyond that, the membership management, which is self-responsible of its actions, ensures that anonymous vested interests are excluded from all strategic decisions.

While the general notion of a cooperative has been around for decades and is well understood, to our knowledge the specific application of the concept to the domain of cloud computing has not been investigated before, except for the previous work of the authors: Haselmann et al. (2011); Haselmann and Lipsky (2012); Haselmann (2012).

3 CLOUD INTERMEDIARIES

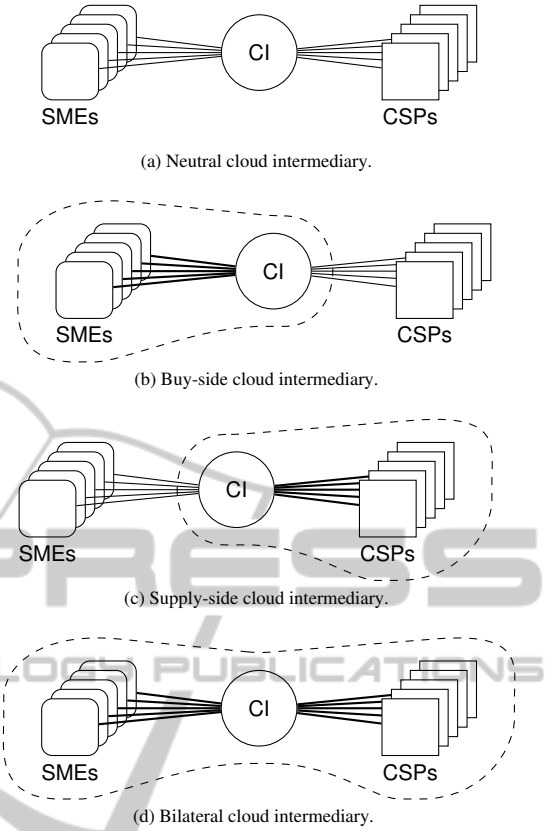
3.1 General Notion

If an intermediary focuses on the cloud domain, it is referred to as a *cloud intermediary*. In the sense of a traditional intermediary, a cloud intermediary arbitrates between supply (CSPs) and demand (potential cloud users) in order to facilitate cloud sourcing for SMEs by reducing the upfront effort of identifying, comparing, and screening the CSPs and their services. To do so, the intermediary propagates best practices and offers specific consultancy. Colloquially, a cloud intermediary helps cloud users "clear the service jungle" so that they can find a suitable match easier and, thus, cheaper. Evidently, a cloud intermediary is also a type of cybermediary.

Note that a cloud sourcing is an external procurement of IT services. The generic service process can be structured into the three phases *information*, *agreement*, and *settlement* (Lindemann and Schmid, 1999). While in principle a cloud intermediary can participate in any of these phases, it is to be expected that its focus lies on the first two phases because the nature of the business between buyer and seller thus remains largely untouched (Giaglis et al., 2002).

3.2 Linkage Variants

Independent of the business model details, an intermediary has to position itself between buyers and suppliers. There are four conceivable linkage variants (Haselmann, 2012):[4]



(a) Neutral cloud intermediary.

(b) Buy-side cloud intermediary.

(c) Supply-side cloud intermediary.

(d) Bilateral cloud intermediary.

Figure 2: The four conceivable linkage variants for cloud intermediaries in which a cloud intermediary can be biased towards buyers and/or suppliers.

- Neutral (unbiased) cloud intermediary
- Buy-side cloud intermediary
- Supply-side cloud intermediary
- Bilateral (mutual) cloud intermediary

These four linkage variants are explained in detail in the subsequent subsections. Figure 2 gives a graphical overview.

3.2.1 Neutral Cloud Intermediary

A *neutral* cloud intermediary is formed as an independent party between buyers and suppliers. It is, thus, biased neither towards CSPs nor towards cloud users. Such a cloud intermediary could be an independent consultancy or an operator of a cloud service market place. SPOTCLOUD is an example of the latter category, being a market place for IaaS products. Registered users can offer their unused CPU capacity or storage space. Clients buy virtual resources "apiece"

[4]The four linkage variants presented here are based on the three generic cases from Klein and Teubner (2000). Those cases were adapted to the cloud context. While the original model did not distinguish the cases of a neutral (unbiased) and a bilateral (mutual) intermediary, this distinction seems appropriate for the cloud case; for a detailed argumentation see below.

without knowing which user is acting as their CSP. SPOTCLOUD fulfills all duties connected with matching supply and demand as well as settlement.

Obviously, such a market place works best for highly standardized cloud services. Such services are typically found at the infrastructure level (in particular storage and CPU capacity). Distinctive attributes of such services are clearly delineated and the abstract services are not substantially different between different providers. For services with high specificity, such as most cloud platform services, matching of supply and demand becomes much harder.

3.2.2 Buy-side Cloud Intermediary

A *buy-side* cloud intermediary is formed by a joint venture of potential cloud users that would like to bundle their cloud-related activities in order to realize synergies and scale effects.[5] The cloud intermediary is, hence, an agent of the cloud users and strongly biased to enforce these users' interests towards CSPs. The intermediary focuses on the users' problems, such as service identification, provider selection or migration from one CSP to another. Typical examples for buy-side intermediaries are THE CO-OPERATIVE and EURONICS; ICT-enabled versions are typically group buying websites such as GROUPON MYCITYDEALS.

The main advantage of this type of intermediaries lies in the bundling of its users' demands. This allows many small enterprises to aggregate their market power and act with the virtual size of a much larger enterprise. In consequence, the intermediary has an improved position for negotiating contracts and prices. In addition, buy-side cloud intermediaries can help introduce new technologies or exchange best practices among its users. Established principles of intermediation can be transfered from "older" industries to cloud sourcing. Real-world examples of such buy-side cloud intermediaries do not yet exist to the authors' knowledge.

3.2.3 Supply-side Cloud Intermediary

If a group of CSPs that share a common goal forms a joint venture, it is called a *supply-side* cloud intermediary.[6] The intermediary is then an agent of the suppliers and is, thus, biased towards enforcing their interests. The formation of such a cloud intermediary is attractive mainly for small players in the cloud market that offer complementary services. Using a supply-side cloud intermediary, these companies can offer a more comprehensive coherent portfolio. Thus, they address a larger group of target customers because they can also reach customers who are looking for a one-stop solution instead of a "service jigsaw". An example of a supply-side cloud intermediary is the APPEXCHANGE platform by SALESFORCE that provides a single unified platform for offering and finding extensions to the SALESFORCE CRM system.

3.2.4 Bilateral Cloud Intermediary

The final conceivable case is that of a *bilateral* cloud intermediary. Such an intermediary arbitrates between cloud users and CSPs while being tied to both sides. This is particularly relevant when there is a group of enterprises that plan a close cooperation based on a mid-term to long-term horizon. In this scenario, a bilateral cloud intermediary can reduce the coordination overhead between the partners and allow for the realization of economies of scale, scope and skill.

This solution, however, is only suitable for a very limited number of scenarios. In particular, it is only viable if various partners would like to create a closely linked ecosystem around a common goal, a common product or a common problem. For example, the OPEN SOURCE AUTOMATION DEVELOPMENT LAB (`www.osadl.org`) brings together software developers and users with the common goal of fostering the development of open-source software. Without this intermediary, most participants would not publish their enhancements of open-source software ("why pay for the result and then give it away for free?") or prefer a solution with proprietary vendor-specific software to an open-source solution. Notice that the bilateral case might address the challenge of data privacy.

We point out that the distinction between a neutral and a bilateral cloud intermediary is subtle, but important. A neutral cloud intermediary will always align its strategy with the demands of its target customers, which may change in the course of time. An enterprise that is in the group of target customers might not stay a member in the long run. Besides, a neutral cloud intermediary will base its strategy on the *intersection* of the customers' various demands and disregard the specific demands of smaller subsets. A bilateral cloud intermediary, on the contrary, has two fixed groups of target customers. It will, therefore, align its strategy with their exact needs and adjust the strategy in case the demands change over time.

[5] In rare cases, there are singular enterprises on the buyer side that have such an importance in the market that they can form their own buy-side cloud intermediary.

[6] In this case, too, there is the possibility of a very large provider forming a supply-side cloud intermediary on its own. A real-world example is the APPEXCHANGE platform.

3.2.5 Comparison and Evaluation of the Four Variants

It is obvious that not all linkage variants are equally well suited to address the issues of SMEs as outlined in Section 2.2. Clearly, neither a neutral cloud intermediary nor a supply-side cloud intermediary can address the interests of the cloud *users* – these variants can, thus, be sorted out. A bilateral cloud intermediary acts – at least to some extend – as an agent of cloud users; however, it must always consider the demands of the suppliers as well and is only appropriate for a very limited number of scenarios. In contrast, a buy-side cloud intermediary (Figure 2b) seems to be suited well to address both the interests of the cloud users and the trust issues that SMEs see with a cloud sourcing. Subsequently, we will therefore constrain our analysis to this variant.

3.3 Business Models

3.3.1 True Intermediary Business Models

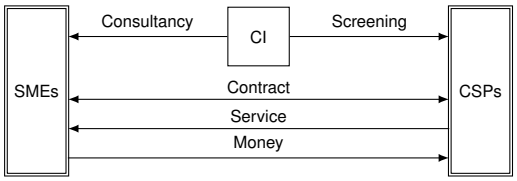
Two general business models can be distinguished depending on how comprehensively the cloud intermediary acts as a middleman between two parties: cloud brokers and cloud traders.

A *cloud broker* is limited to the negotiation of contracts between cloud user and CSP. Towards the CSP it mainly performs a screening and assessment; towards the cloud user, it provides consultancy and curated information on various market aspects. Thus, it supports the initiation and negotiation phases of the service process. The actual contract is still closed directly between cloud user and CSP.

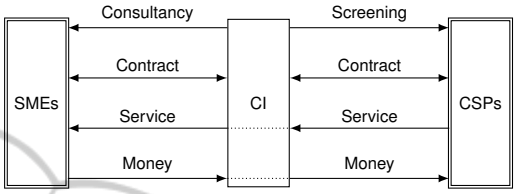
In contrast, a *cloud trader* acts as a distributor and reseller of cloud services by closing contracts with various cloud users and satisfying the demands by closing matching contracts with CSPs. The services of CSPs can be made available to users either transparently (i. e., it is clear that a certain third-party CSP is providing the service) or relabeled as a proper service (i. e., the cloud trader appears as service provider). The same is true for the payment of service fees, which can be paid either to the cloud intermediary or to the original CSP (which, in turn, reimburses the cloud trader). These two business models are shown schematically in Figure 3.

Both business models offer essentially the same advantages and disadvantages for customers.[7] A notable difference is that a cloud trader cannot only support

[7]We abstract from the differences between various business models on the side of the cloud intermediary because the analysis is performed from a user's point of view.



(a) Cloud broker as a facilitator of contracts.



(b) Cloud trader as intermediate agent and independent contract partner.

Figure 3: Two business models for a CI that a acts as a cloud broker or b as a cloud trader.

the negotiation phase by providing consultancy, but it can even enhance the market position of its customers. To do so, it bundles the users' demands thus gaining *virtual size* and a better position for negotiating rebates. Typically, this also implies that a cloud trader has to bear the planning risk for the congruence of supply and demand (e. g., because there are upper and lower bounds on the amounts of contracted resources).

3.3.2 Hybrid Business Models

Since a genuine cloud *intermediary* does not offer any cloud services of its own (cf. Figure 3), there are no requirements for costly investments in IT infrastructure. Also, it is easy for the founders to liquidate a cloud intermediary and return to unmediated transactions in case it turns out that a solution with a middleman is unsuitable. The principal advantage of a cloud intermediary lies in the rather objective and customer-specific consultancy that can highlight reliable CSPs, propagate best practices and architectural approaches etc. A cloud intermediary can, thus, be of significant help for SMEs that have no cloud experience worth mentioning – which is the majority of SMEs as of time of writing.

The fact that a cloud intermediary does not offer any proper cloud services is, nevertheless, also a limitation. A genuine cloud intermediary cannot provide any custom services that are tailored specifically to the users' needs or compound services that provide added value based on a composition of other (probably third-party) cloud services. In essence, a cloud intermediary provides a "selective public cloud" due to the careful selection of publicly available cloud services. Thus, it can guarantee, e. g., a minimum service level but it cannot address the basic concerns that many SMEs have with a public cloud.

A well-known workaround for many issues of the public cloud model is the so-called *community cloud* model, in which a provider offers a cloud to a clearly defined group of clients, making it a "joint private cloud". A community cloud does not offer a physical separation of clients as it is provided by a private cloud, nor does it feature a far-reaching logical separation as a virtual private cloud offers. It does, however, offer a physical separation of its members from non-members, making it suitable to address many privacy and information security concerns of a public cloud.

An attractive setting is given by a cloud intermediary that is also a community cloud provider. In this case, all benefits of a cloud intermediary are combined with the possibility to offer custom services that are tailored towards the needs of the members of the cloud intermediary. These services can comprise both completely self-provided functionality and compound services, created from a combination of third-party cloud services (providing some kind of added value); they are also referred to as *higher-order services*. A cloud intermediary that also acts as a CSP is called *hybrid cloud intermediary*.

While it is beneficial for SMEs in many cases to contract services through a cloud intermediary, it is not the only solution. Instead, they can contract directly with trusted CSPs or other intermediaries. The complete scenario around a hybrid cloud intermediary is shown in Figure 4.

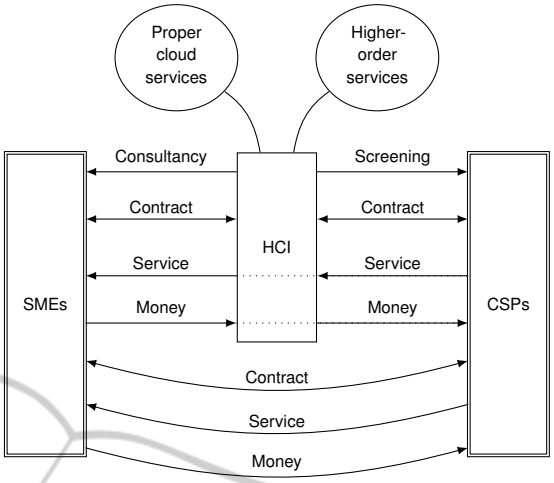


Figure 4: Typical complex scenario with a hybrid cloud intermediary.

4 BUY-SIDE HYBRID CLOUD INTERMEDIARIES

4.1 Examining Transaction Costs and Production Costs

In order to analyze whether intermediation is appropriate, we assume a scenario in which several SMEs would like to procure a cloud service that is offered simultaneously in a similar manner by several CSPs. Two relevant dimensions for this analysis are the *degree of in-house production* and the *scope of cooperation*. The first dimension is divided into three levels:

1. *None* – There is no in-house production, the cloud service is used directly ("as-is").
2. *Partial* – The cloud service is enriched by additional (minor) features, making it a higher-order service and requiring some in-house production.
3. *Complete* – The service is not procured from a third party and is, therefore, completely provided in-house.

Independently, the cooperation dimension can also be divided into three levels:

1. *No Cooperation* – All SMEs directly interact with the CSPs.
2. *Preparatory Phases* – The SMEs cooperate in the preparatory phases of the service process, i. e., mainly in the initiation phase and possibly to some extend in the negotiation phase; cooperation is handled by a cloud intermediary.
3. *Entire Service Process* – The SMEs cooperate during the entire service process; cooperation is handled by a cloud intermediary.

This results in nine scenarios, which are depicted in Figure 5. In order to show that a solution based on a cooperation with a cloud intermediary is preferable over a solution without cooperation, we need to analyze the transitions from the left column to the middle and right columns. We do this row by row, i. e., we assume a fixed level for the degree of in-house production. Thus, we need to show that the transitions depicted as solid arrows in Figure 6 are actually beneficial for the involved SMEs. In order to do so, we perform a differential analysis of both transaction costs and production costs for each transition in question. As the analysis follows a very similar line of argumentation for all transitions, we describe our argumentation in general and leave the application to each individual transition to the reader.

Looking at the transitions from the left column (no cooperation) to the middle column (cooperation in preparatory phases of the service process),[8] it can be observed that a cloud intermediary can support SMEs in the initiation and (partially) in the negotiation

[8] that is, $S_1 \rightarrow S_2$, $S_4 \rightarrow S_5$ and $S_7 \rightarrow S_8$.

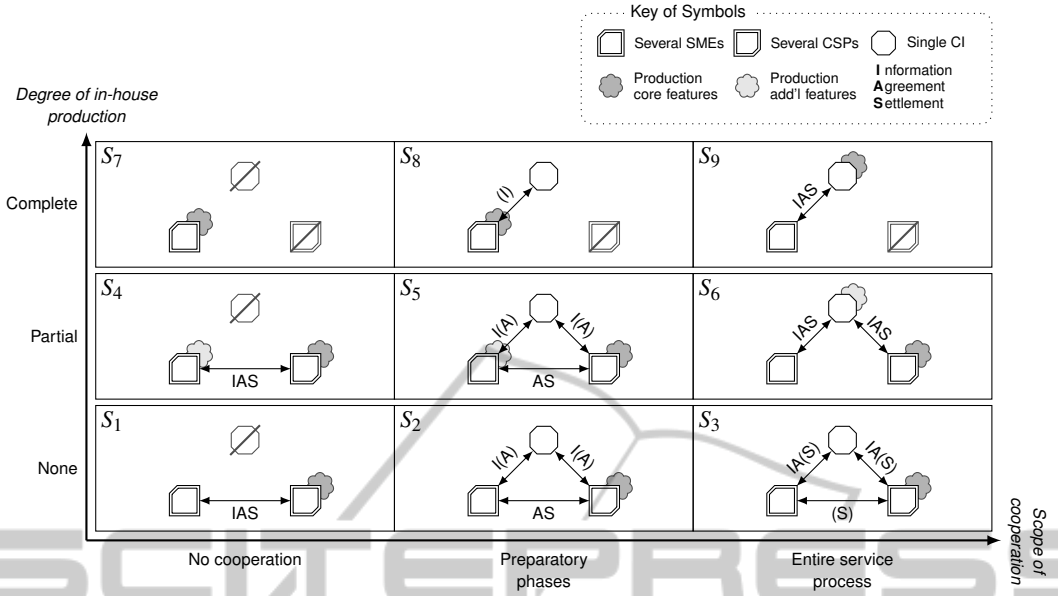


Figure 5: Overview of the nine analyzed scenarios.

phases. It does so by providing filtered and aggregated information, i. e., specific consultancy to the SMEs. While the benefit is not apparent in the case of a single enterprise, it becomes obvious when a group of SMEs with shared goals is observed. In that case, transaction costs for finding and negotiating a cloud sourcing contract are significantly reduced due to economies of scale in the cloud intermediary. In cases where there is in-house production, the cloud intermediary can also foster the exchange of knowledge and best practices among the SMEs.

Similarly, when analyzing the transitions from the left column to the right column (cooperation during the complete service process),[9] a cloud intermediary can provide the same advantages as outlined for the previous case. In addition, it can realize further economies of scale, skill, and scope. For instance, it can aggregate the demand of all SMEs and negotiate quantity rebates. Being involved during the entire service process, it can also provide more comprehensive support for all enterprises at a higher efficiency than the individual SMEs could. It is, thus, likely that even the transitions from the middle to the right column are beneficial (indicated by dashed arrows in Figure 6).

Having established that the relevant transitions are beneficial considering transaction costs, we will now take a look at production costs as well.[10] With increasing cooperation, SMEs are able to realize significant economies of scale if they have a mutual cloud intermediary handle the service production. Even if not cooperating, the production cost are not influenced by the presence of a cloud intermediary. Therefore, the relevant transitions are not detrimental (in the worst case), but rather expected to be quite advantageous (in the likely case).

In conclusion, it can be shown across all identified scenarios that a cooperative solution based on a cloud intermediary is indeed beneficial for a group of SMEs that are willing to cooperate on their cloud sourcing activities. Regarding transaction costs, it is always beneficial to engage a cloud intermediary (given the assumptions for a "typical" SME from Section 2.2). While this is not always the case for production costs, it is clear at least that production costs never increase when engaging a cloud intermediary; for the average case, SMEs can even expect decreases in production costs as well. Figure 6 summarizes these results graphically.

4.2 Specifying the Notion of a Hybrid Buy-side Cloud Intermediary

As introduced in Section 2.3, a cybermediary can be characterized by specifying its value propositions, key activities, and key resources (cf. Figure 1). For a cloud intermediary, the services that are offered are of particular relevance. Therefore, the model is adapted to depict explicitly four different "types" of IT services: "pass-through" services that are made available without change; proper services that the cloud intermediary is providing, acting as a genuine CSP; "atomic" ser-

[9] that is, $S_1 \rightarrow S_3$, $S_4 \rightarrow S_6$ and $S_7 \rightarrow S_9$.

[10] The third row from Figure 5, i. e., scenarios without in-house production, are not considered because transitions in that row obviously do not imply any change in production cost.

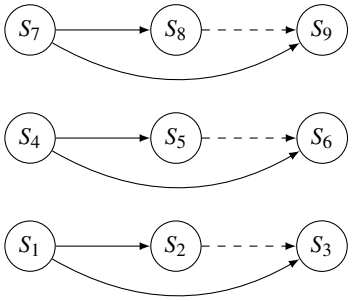


Figure 6: Analyzed transitions between scenarios, distinguishing certainly beneficial transitions (solid arrows) and probably beneficial transitions (dashed arrows).

vices that serve as building blocks for more elaborate compound services; and compound services[11] offered by the cloud intermediary that are composed of other services and provide some kind of added value over the "raw" services. The adapted model is depicted in Figure 7. It allows to characterize any variety of cloud intermediary.

In this section, we will characterize a prototypical hybrid buy-side cloud intermediary, i. e., an intermediary that is founded by (or at least strongly biased towards) a group of SMEs that would like to engage in a cloud sourcing. While the services may be very different for each hybrid buy-side cloud intermediary depending on its customers' requirements, the market environment and so on, the core features – value proposition, key activities, and resources – can be characterized quite generically. In the following analysis, we, therefore, focus on the shaded boxes of Figure 7.

Core Value Proposition. As argued so far, the core value proposition of a hybrid buy-side cloud intermediary is the significant reduction of transaction costs for all participants in cloud markets, thus overall providing more attractive transactions for buyers and sellers. It does so based on the "traditional" intermediary functions of matching suitable transaction partners (i. e., mainly finding adequate CSPs for the customer SMEs) and providing aggregated information about suppliers to buyers and vice versa. Being in between both sides of the cloud market, it can provide stability of business relations and technical interfaces (even if CSPs or SMEs change). Under certain circumstances, it can even take on the role of a trusted third party, thus possibly acting as a *trust anchor* (particularly for the comparatively small SMEs facing global cloud providers).

[11] Also referred to as *mash-ups* in the Web 2.0 context.

Buy-side Value Proposition. Being a buy-side intermediary, it is clear that the most important part of the value proposition targets the buy-side customers, i. e., the cloud user SMEs. For these enterprises, the cloud intermediary can help with the (typically) very tedious vendor selection and screening process that precedes any cloud service procurement. In that phase it can also provide guidance on architectural, technological and implemention-related choices. It can even ensure stability of technical interfaces in cases where CSPs do not guarantee it. In addition, the cloud intermediary can provide complementary IT services that are not available on the market. Last, not least, it can put SMEs into a better position for negotiations with CSPs (by providing a larger virtual size). Due to the fact that a cloud intermediary can reduce the transaction costs related to a cloud sourcing to a degree that cloud services become a viable alternative for SMEs, a cloud intermediary can act as a *cloud enabler*.

Supply-side Value Proposition. On the supply-side, the value proposition is given mainly by the core value proposition. Nevertheless, some specific benefits of a cloud intermediary can be identified. Firstly, a cloud intermediary acts as a single point of contact for CSPs which hence can reach all associated SMEs through a single channel. This implies less administrative overhead for a CSP and a more interesting scale for sales. Secondly, dealing with a cloud intermediary means that a CSP deals with an experienced partner that encapsulates all required domain knowledge about its customers (the SMEs) and relieves a CSP of translating their needs into technological requirements.

Key Activities. The cloud intermediary provides these benefits by performing several key activities. First of all, it performs a market analysis, identifying and screening relevant CSPs. The intermediary then negotiates contracts on behalf of the associated SMEs. In doing so, it can benefit from having consolidated and standardized its customers' requirements, thus developing a concise portfolio of required services and achieving better economies of scale. It then helps with the procurement and integration of the services into the individual IT landscapes. If desired, the cloud intermediary can also take care of the settlement of PPU fees and other service charges. When the intermediary also acts as a proper CSP, it needs to operate selected cloud services and provide relevant compound services based on either in-house or cloud infrastructure.

Key Resources. The key resources of a cloud intermediary are two-fold: domain knowledge about the cloud market and the market participants as well as

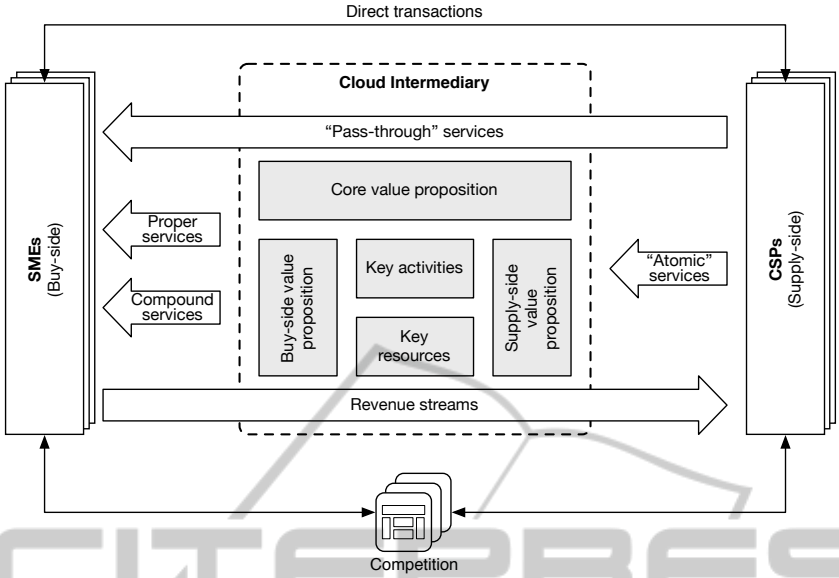


Figure 7: A cross-perspective consolidated model of cloud intermediary value-creation, adapted from the generic model by Rensmann (2012a) (cf. Figure 1).

domain knowledge about cloud services, cloud operations, service providing, and service procurement. On the one hand, the intermediary relies on its specific knowledge of both its customers (the buy-side SMEs) and about relevant market players and appropriate selection and screening procedures. On the other hand, it has to have knowledge about efficient infrastructure operations and service providing as well as about best practices that buy-side SMEs should follow when sourcing services from "the cloud".

5 COOPERATIVE GOVERNANCE FOR A CLOUD INTERMEDIARY

As the previous section has shown, resorting to a buy-side hybrid cloud intermediary is, in general, beneficial for SMEs. Since an appropriately designed cloud intermediary can reduce the upfront costs of using cloud services in SMEs to such a degree that it in fact enables SMEs to use cloud services at all; hence, a cloud intermediary can act as a *cloud enabler* (as argued in the previous section). However, there are some remaining issues that need to be addressed:

- The cloud intermediary does not protect the buy-side SMEs from a hold-up[12] by the CSPs. Cloud users are typically dependent on a single vendor because of various forms of *vendor lock-in*: proprietary data formats, proprietary scripts or macros, unique API calls etc. Migration to another vendor in such a scenario is then so costly that the CSP can extort the cloud user up to the migration costs.
- The described setup concentrates risk for the SMEs at a single point, namely the cloud intermediary. This happens both consciously and unconsciously because of knowledge transfer or transfer of assets to the cloud intermediary. Over time, the cloud users may be deprived of the knowledge and assets that would be required to "backsource" the outsourced services into the enterprise.
- The described setup leads to a double principal-agent situation.[13] By introducing another party between buyers and sellers, there is a risk of increasing information asymmetries instead of ameliorating them. The cloud intermediary has to be designed appropriately so that its relations to the buy-side SMEs are close enough to bridge the information gap.

These issues cannot be addressed simply by introducing an intermediary; rather, they require appropriate governance structures for the cloud intermediary. One particularly suitable governance form is the cooperative, which we now apply to the specific case of buy-side hybrid cloud intermediaries, showing its distinct advantages.

The combination of the general concept of a buy-

[12]The term "hold-up" is a technical term from transaction cost theory; see, e. g., Picot et al. (2008).

[13]For an introduction to the theory of agency see, e. g., Picot et al. (2008).

side hybrid cloud intermediary with cooperative governance structures results in a cooperative that is formed by a group of cloud users (SMEs) that have shared goals with regard to their cloud activities but do not necessarily come from the same industry or may even be competitors. The cooperative instruments are an effective means of handling opportunistic behavior and, thus, creating trust (cf. Section 2.4). The resulting entity is concisely referred to as a *coop cloud*. Thus, a coop cloud is schematically equivalent to Figure 2b, with the CI being organized as a cooperative.

The first effect of forming a coop cloud is that the external interdependency between an SME and a CSP is replaced by an internal interdependency between the cooperative members. This internalization has to be advantageous for each coop cloud member to minimize the opportunistic behavior between the SMEs. Instead of contracting with an unknown external transaction partner, the SMEs help themselves by forming their own "meta-CSP" as a cooperative joint venture. They now contract with the coop cloud, a partner they are involved in and that is democratically managed by the "one-man-one-vote"-principle balancing all members' interests. Because of the fact that a cloud user is also co-owner of the coop cloud, the user has full control and trust in the provided cloud services. The self-government element prevents external interests from influencing the cloud intermediary. On a side-note, the cooperative members are not required to purchase their cloud services through the coop cloud. In fact, the set-up is flexible enough to allow some member's particular requirements that are out of the scope of the coop cloud to be fulfilled externally. In general, however, we expect the cooperative members to channel their cloud activities through the intermediary because of the described advantages.

This cooperative mutualism in the creation of identity among the members lowers the risk of opportunistic exploitation and the agency costs. The operationalization of this mutualism is the creation of values, in a nutshell, the *MemberValue*, which is the total value of the members' entrepreneurship and consists of three facets (cf. Section 2.4). The direct MemberValue represents the value of having access to the coop cloud's services, including both technical cloud services and non-technical services, such as consultancy. The indirect MemberValue stems from efficient value creation and payment flows (dividends) to the members. Finally, the sustainable MemberValue consolidates all values from investments to guarantee continuation and expansion of the coop cloud, e. g., investments for developing new and innovative services for the community cloud and its members.

Another advantage of a coop cloud is the creation of virtual economies of scale. Inside a cooperative – unlike most other governance forms –, the risk of selecting a wrong partner (adverse selection) is shared by all members. The search costs for new members, services or optimal solutions are shared as well. Still, all members keep their identities and all SMEs remain self-dependent (so-called cooperative individualism). Although stability is generally ensured by the cooperative statutory regulations, the barrier to enter or exit the cooperative for a single member is rather low. Lock-in costs are relatively small because the members are entitled to a refunding of their deposit. However, it is problematic if a large portion of the members exits simultaneously because that can easily overstrain the capacity of the coop cloud. In that case, an upkeep of proper operations might not be feasible.

Lastly, a secure legal framework is extremely important for the dissemination of cloud services among SMEs. With the establishment of a coop cloud, this can partly be guaranteed, particularly regarding critical aspects like privacy protection laws. It is also vital that members retain full access to their data and have the possibility to "withdraw" their data from the cloud whenever they want to. Having less legal leeway than other forms of cooperation, cooperative structures can provide such a setting as their narrow statutes create trust among its members and provide stability in the volatile cloud services domain.

In conclusion, the combination of a buy-side hybrid cloud intermediary with cooperative governance structures can indeed address the three identified issues. It can do so better than most other governances forms because of its characteristic traits. However, this still requires the cooperative be designed appropriately – a task that is facilitated by the fundamental ideas of a cooperative.

6 DISCUSSION & LIMITATIONS

We have brought together various economic approaches and theories to build a possible solution for SMEs getting involved in cloud computing that can lower entry barriers, in particular upfront (transaction) costs and trust concerns. It could be shown that our solution is advantageous under the assumptions mentioned. However, there are also some limitations to our approach.

Cooperative structures are designed and profitable for a long-term perspective. They are, therefore, suitable neither for SMEs that want to engage in a single cloud project or very short-term cloud usage nor for SMEs that want to retain utmost flexibility with regard to their operations. From our experience, how-

ever, most SMEs are looking for medium to long-term relationships with their business partners. Another open question in this context is the optimal size of a coop cloud because too few members may lead to an economically unattractive situation, whilst too many members may render the cooperative inflexible.

Further, a cooperative cannot fulfill every special requirement of individual members. Depending on the fit of the members' requirements, it may be easier or harder (or even impossible) to find a solution that suits all members. Therefore, a coop cloud may not be a viable solution if an enterprise has unique requirements with respect to data protection.

In our analysis, we have focused on comparing costs for two scenarios: a setting with an established intermediary and a setting without one. This ignores the costs associated with the setup and launch of the intermediary, in particular also the costs of forming a cooperative. The launch of a coop cloud occasions, e. g., costs for searching founding members, marketing costs for finding more potential members later on, costs for setting up a shared infrastructure etc. Our analysis is valid, nevertheless, because the setup cost is negligible in long-term considerations. Also, it represents the situation where an SME decides on whether to join an already existing intermediary organization. We expect this to be the more frequent case once first coop clouds are established.

Finally, we have to highlight that cooperatives are a country-specific construct. Thus, it may not be feasible to adapt it for a particular country. However, our solution can be considered as a reference model which suits European legislature as well as cooperatives in the USA. Therefore, a very large part of cloud users are able to benefit from a coop cloud in principle. Some country-specific particularities will have to be respected, of course, and the cooperative governance structures have to be modeled adequately.

7 CONCLUSIONS AND FUTURE WORK

In this paper, we elaborated on the particular situation of SMEs in the cloud services domain and motivated the need for new governance structures. In order to address the identified issues, we have provided a 360-degree view of the concept of a hybrid cloud intermediary. This type of intermediary is particularly suited to enable SMEs to engage in a cloud sourcing. Therefore, we have focused our analysis on buy-side intermediaries. Drawing on an existing framework for characterizing cybermediaries, we have detailed the value proposition and key activities of a cloud intermediary. In addition to the market-structural perspective, we have provided a suggestion for specific governance structures based on the cooperative paradigm. The resulting entity is concisely named *coop cloud*.

A hybrid cloud intermediary in general – and a coop cloud in particular – can reduce the upfront costs associated with a cloud sourcing by reducing the transaction costs significantly for participating SMEs. A hybrid cloud intermediary thus acts as a cloud enabler for SMEs. Specifically, a cloud intermediary can support the initiation, provider selection and contract negotiation, i. e., the early phases of a cloud sourcing process. The intermediary mainly provides domain-specific consultancy. If designed correctly, it can also address some of the prevailing trust concerns. In conclusion, a coop cloud can mitigate – to a certain degree – the lack of trust, control and certainty about legal issues as well as strengthen regional economic structures vis-à-vis global players.

For the described approaches are still work in progress, they lack empirical confirmation. This is one of the major steps for our future work. Additional future research is directed at investigating the current limitations identified in Section 6.

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