Web 2.0 versus SOA: Converging Concepts Enabling Seamless Cross-Organizational Collaboration

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Abstract

A new type of Web-based applications such as interactive encyclopedias, Blogs and Mash-ups has been gaining momentum during the last years and is frequently referred to as Web 2.0. A topic that has experienced a lot of interest recently is the relationship between Web 2.0 and Service-Oriented Architectures (SOAs). The notion of complexity-hiding and reuse, but also the concept of loosely coupling different services has inspired the scientific community to elaborate on similarities between the two concepts Web 2.0 and SOA. In this work, we thoroughly examine and contrast them from a technical and economic perspective to reveal discrepancies and similarities and conclude with the vision of an Internet of Services that leverages technologies and design principles from both concepts. Based on case-studies we draw a picture of this upcoming generation of the Internet and conclude with a first analysis of its significant implications on cross-organizational collaboration.

1. Introduction

The term Web 2.0 has been coined by Tim O'Reilly in 2005 [1] to describe a quickly growing set of Web-based applications that share a common philosophy of "mutually maximizing collective intelligence and added value for each participant by formalized and dynamic information sharing" [2]. Interactive encyclopedias, Blogs and Mash-ups are exemplary applications of the Web 2.0 era. Due to its strong impact on the way the Web is perceived by users and also due its relevance for businesses, Web 2.0 has attracted the attention of both mass media and the scientific community. Recently, a discussion about similarities and differences between the concepts of Web 2.0 and SOA has been initiated within the scientific community [3]. SOA is considered as the philosophy of encapsulating application logic in services with a uniformly defined interface and making these publicly available via discovery mechanisms [4]. Service consumers may then retrieve these services, compose and use them according to their current needs. The loose coupling of services via standardized services interfaces allows for operational agility and is considered as one of the central advantages of SOA as compared to conventional IT design concepts [5]. The notion of complexity-hiding and reuse, but also the concept of loosely coupling services has inspired researchers to elaborate on similarities between the two concepts SOA and Web 2.0 and their respective applications [6]. This work is devoted to analyzing whether Web 2.0 and SOA share common ground or not and if there is potential for synergies between the two concepts. The emerging Internet of Services is finally cited as exemplary case for the combination of technologies and design principles from both Web 2.0 and SOA and is analyzed with respect to its impact on cross-organizational collaboration.

The remainder of the paper is structured as follows: Chapter two deals with a clear definition of both Web 2.0 and SOA to allow for a systematic analysis and also presents the research approach. Chapter three contrasts them along the business model components proposed by the selected methodology. In Chapter four, we elaborate on the emerging Internet of Services and its profound impact on cross-organizational collaboration. Chapter five closes the work with a brief summary.

2. Definition of terms and research approach

This section briefly introduces the two concepts Web 2.0 and SOA that are in the center of this work. According to Tim O'Reilly, who originally coined the term, the following principles are central to the Web 2.0 concept [1]. First, the Web is considered as a platform for building systems that do not necessarily have a specific owner and are "tied together by a set of protocols, open standards and agreements for cooperation". Harnessing collective intelligence of Web users, the ownership of mission-critical data and the end of the software release cycle represent further cornerstones of the Web 2.0 concept. Finally, the implementation of lightweight programming models and the realization of rich user experience are also

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central principles of the Web 2.0 phenomenon. In this work, we use the following abstract definition [2]: "Web 2.0 is defined as the philosophy of mutually maximizing collective intelligence and added value for each participant by formalized and dynamic information sharing and creation".

Since the late 1990s, many definitions of SOA have been published [7, 8]. The widely accepted OASIS Reference Model for SOA [4] defines SOA as "…a paradigm for organizing and utilizing distributed capabilities that may be under the control of different ownership domains. It provides a uniform means to offer, discover, interact with and use capabilities to produce desired effects consistent with measurable preconditions and expectations".

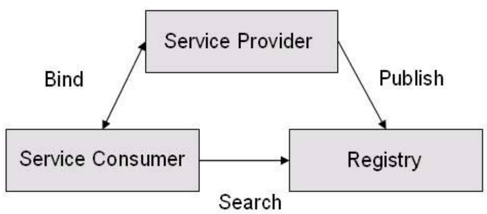

Figure 1: Basic Service-Oriented Architecture

According to this model (see Figure 1), the major components of a basic SOA and their possible interactions are: a service provider publishes his service interface via a service registry where a service requester can find the service and subsequently may bind to the service provider. The central concept of the SOA Reference Model is the existence of services which provide access to capabilities by well-defined interfaces to be exercised following a service contract with certain policies. This enables a loose coupling of services (thereby minimizing mutual dependencies) and ensures operational agility.

The research approach applied for the comparative analysis of the two concepts Web 2.0 and SOA is based on the examination of numerous real-world uses-cases: In the cases of Web 2.0, 40 different applications that enjoy the greatest popularity [2] (based on user numbers and citations) have been chosen as representative examples. SOA case studies exposed by different vendors of SOA-related services or technology such as SAP and IBM as well as studies provided by renowned analyst firms were used as a foundation for this work as well. The **MCM Business Model Framework** [2] has been leveraged to structure our comparative analysis along seven major components: First, the *Features of the Specific Product* component comprises the actual design of a product or service and its value proposition for the customer. *Features of the Specific Medium* defines the technological foundation of a product. The *Customers* component explains the specific needs of target customer groups. Fourth, the *Value Chain* component is devoted to reflecting all players that are involved in the production and delivery of a product and their respective interrelationships. The component *Financial Flow* identifies revenue models, while *Flow of Goods and Services* describes the stakeholders' activities that are essential for the creation of the product or service. Last, the *Societal Environment* reflects relevant outside influences on a business model (e.g., legal and social aspects).

3. Web 2.0 versus SOA

3.1. Features of the specific product or service

According to [2], Web 2.0 applications can be classified as follows: First, **communities** aim at unifying their users by means of a common ideal such as social networking (e.g. LinkedIn[1]), knowledge sharing (e.g. Swicki[2]) or participation in a special interest group. Second, certain **platforms or tools** enable users to create and share content or even application functionality with a broad audience. The Yahoo! Pipes Mash-up platform[3] represents one popular example: Without any coding efforts, users are empowered to use so called news feeds (RSS-compliant pieces of information) from arbitrary sources (e.g., from newspapers Web sites) in the Web, combine, filter (according to individually definable key-words) and again expose the resulting feed with the help of the intuitive Yahoo! Web interface. In this way, individuals may create their tailor-made news-paper which only provides them the information they are interested in. **Online collaboration tools** support users in collaboratively performing certain tasks such as performing online collaborative brainstorming.

SOA use-cases can be differentiated as follows: First, SOAs allow for **cross-organizational integration of services**. By adhering to common standards for the description of their service interfaces and of process choreographies, corporations are enabled to setup loosely and thus quickly changeable interconnections with other companies. Second, SOAs facilitate the **intra-organizational integration of disparate services**. IT-applications that may be heterogeneous with respect to underlying technical platforms, programming languages and interface parameters can be encapsulated with uniform interfaces. The resulting services can then be composed and loosely coupled with other services

[1] http://www.linkedin.com
[2] http://http://swicki.eurekster.com/
[3] http://pipes.yahoo.com

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according to actual business requirements. The third category of SOA implementations deals with **application development** on the basis of service composition. With the help of SOA development platforms, new composite applications can be quickly setup on the basis of existing services as reusable code shortens development time and makes applications accessible to a wider user base without requiring complex system-to-system integration.

The first major **analogy** between Web 2.0 and SOA implementations is the notion of reusing and composing existing resources. As argued above, Web 2.0-concepts allow users to freely reuse and remix content or functionality from arbitrary Web-based sources and expose the results as new services. SOA bears strong resemblance to this principle as it ultimately regards every service as a potential building block for assembling and providing new, higher level services. The second commonness is the affinity to collaboration and coupling of remote resources or services. In the Web 2.0 context, numerous services are available online and can be easily and loosely coupled with other applications (e.g., RSS-based information Mash-ups). SOA adheres to this principle of loosely coupling distant services within or across organizational domains as it substitutes vertically oriented island applications by easily accessible Web Services. A third apparent resemblance between Web 2.0 and SOA is the shared principle of agility and the support of permanent structural change: The key value of many Web 2.0 applications depends on the almost unlimited possibility to syndicate content from arbitrary sources and quickly adapt structures to changing user preferences. Flexibility is also one of the major benefits of SOA implementations: as market demands change over time, SOAs enable companies to quickly redesign inter-organizational processes efficiently.

Web 2.0 and SOA application also expose **divergent elements**. First of all, many Web 2.0 applications incorporate a social aspect that conventional SOA is completely lacking. SOAs focus on facilitating efficient machine-to-machine collaboration, while Web 2.0 aims at supporting human interaction via computers and mainly also deals with human-readable content (e.g., text, pictures). Second, Web 2.0 is clearly about presentation and user-interface integration, whereas SOA deployments are more abstract and less visible to its users. Third and last, the degree of ex-ante determination [5] and involved governance is a key differentiator between Web 2.0 and SOA. Due to their predominant implementation in the corporate context, SOAs are subject to rigid governance processes that do not exist in the case of most Web 2.0 applications [9].

3.2. Features of the specific medium

As argued in [10], **Web 2.0** does not stride along with a fundamental technological innovation. However, certain technologies have facilitated the fast Web 2.0 proliferation: First of all, the Representational State Transfer (REST) [11] is an architectural style that enables Web clients to interact with arbitrary Web resources (sources of specific information) in a uniform way and thereby exchange XML-based messages. An XML-based file format, the Really Simple Syndication (RSS) standard supports the easy aggregation of content from arbitrary sources in the Web. AJAX represents a composite of several other technologies that together allow for rich user experiences (especially through minimized data transfer between server and client) which is one of the key paradigms of Web 2.0 applications [1].

As opposed to the “lightweight” [6] Web 2.0 technologies, **SOA**s rely on a set of more complex standards. As WSDL and SOAP-based Web services are the most widely spread standards used to setup SOAs, these are in the focus of this work. First of all, the Web Service Description Language (WSDL) defines a uniform XML format to encapsulate possibly heterogeneous applications with uniform interfaces. The Universal Description, Discovery, and Integration (UDDI) standard is leveraged to define publicly available service registries. On the protocol level, SOAP specifies the data format of the messages to be sent between service provider and requester. The Business Process Execution Language (BPEL) is widely accepted as a standard for orchestrating different services into one process choreography.

As a first major technical similarity between Web 2.0 and SOA applications, the above presented standards RSS and REST aim at **coupling remote applications** via uniform interfaces. Technologies that are typically used in the context of SOAs are designed to support collaboration of distant services as well. Interfaces are described by means of the widely accepted WSDL standard, thereby enabling clients to bind to these interfaces and perform message transactions. Second, Web 2.0 and SOA technologies also share common ground with respect to the notion of **complexity-hiding and the reduction of programming effort**. Standards such as AJAX do not only foster a rich user experience, but are also used for assembling novel simplistic applications without requiring the user to conduct any programming work. SOAs are being deployed in the corporate environment following a very similar goal: Instead of programming business functionality from scratch, uniformly described services (which hide inherent complexity to

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the outside) are leveraged as reusable building blocks in software development.

Two major differences between the technological basis of Web 2.0 and SOA uses-cases have been identified in this work: First, a distinction can be made along the two terms **syndication and coordination**. As described above, many technologies that are used in the Web 2.0 context focus on static syndication of content and services rather than allowing for a stateful and rather complex coordination (choreography of services) between different services as in the case of SOA. The mostly stateless Web 2.0-applications allow users to syndicate content without any mutual agreements prior to implementation, thereby simplifying and facilitating the dissemination. The second difference between Web 2.0 and SOA technologies refers to **semantic interoperability**. As opposed to most SOA use-cases, Web 2.0 applications directly involve human beings. Content is syndicated or functionality is composed in order to directly serve a (fault-tolerant) human user via presentation layer interfaces. SOAs typically are limited to the mere interaction of machines which are not at all flexible to errors: system designers are required to ensure that information exchanged between machines is correctly interpreted and processed by all involved services.

3.3. Potential Customers

In the Web 2.0 context, basically every Web user can be regarded a customer. Instead of heading for a small number of huge customers, Web 2.0 applications aim at involving the bulk of private users or small businesses (the "long tail" [12]). As Web 2.0 services are end user-centric and always involve human interaction, the needs such services account for can be summarized on the basis of the top three classes of human motivation as introduced by Maslow [2, 13]: Web 2.0 applications enable users to obtain the feeling of *belonging*, to *gain recognition* of other participants and also to *reach their fullest potential* by being creative in generating new content or functionality.

In the case of SOA, medium-sized or larger corporations which intend to change their IT landscape are the customers of choice. As argued above, these users aim at introducing SOA as software design principle, as possibility to make the existing landscape more flexible and maintainable or as enabler for establishing efficient and quickly changeable cross-organizational business relationships with other companies. This substantially different spectrum of customer needs results from the fact that SOAs are mainly operated in the corporate context and do not involve individual human needs. A similarity between customers in the fields of web 2.0 and SOA is their active involvement in designing and changing the products they use.

3.4. Value Chain

In the Web 2.0 context, traditional value chains are broken up to a large extent and substituted by loose networks of providers and consumers [2]. Distinct roles such as creators, owners or aggregators of content are no more clearly defined. Instead, every user may publish own content or functionality on the Web and thus become a platform operator, simply consume resources or reuse them to compose new applications and make them publicly available.

As opposed to most Web 2.0 applications, the high technical complexity inherent to SOAs requires the existence of one or several "expert players" such as SAP within the value chain who build and provide solutions to the customers. In contrast to this one-to-many value chain model (one expert serves many clients) of numerous SOA use cases, Web 2.0 value chains are mostly loosely coupled (many-to-many) networks of self-managed users who may offer and consume resources via the Web.

3.5. Financial Flow

Revenue models of Web 2.0-applications strongly differ from traditional models in the software industry mainly due to two facts. As a consequence of the "end of the software release cycle" [1], customers of Web 2.0-applications do not buy a license once in the lifetime of the product any more but are expected to pay for the service on a continuous basis. Second, the number of users and their contributions are part of many Web 2.0-applications' actual value proposition. Service operators thus do not introduce service fees to avoid limiting the amount of users. Only few examples of operators exist that have successfully monetized their services. Charging users for premium services or integrating third-party advertisements into platforms represent common approaches. The revenue models identified in the field of SOA mostly follow a more traditional approach. Typically, customers are companies that intend to streamline their IT landscape or to setup quickly changeable electronic business relationships with other firms. In most cases, they pay license fees for software artifacts from the above mentioned expert firms and also pay for customizing and maintenance services.

3.6. Flow of Goods and Services

Product creation and provision in the field of Web 2.0 is impacted by the "end of the software release cycle" [1]. Rather than being sold as static, over-the-counter artifacts, software is offered as service

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(Software as a Service, SaaS) via the Web. Applications permanently remain in a state that is called "the perpetual beta" [1], in which the product is improved in a continuous fashion (e.g. Google Maps). As a consequence of this paradigm, traditional marketing and sales activities involving numbers of sales representatives are made superfluous. According to O'Reilly [1], many Web 2.0 application providers rely on strategies such as "viral marketing", i.e. recommendations autonomously propagating from one user to another. In the SOA-context, the flow of goods and services again follows a more conventional approach. Large solution providers such as SAP and IBM mostly treat SOA-products as software artifacts that are packaged and then licensed to customers; product marketing and sales also follow conventional approaches.

3.7. Societal environment

As argued above, Web 2.0 use-cases considerably benefit from the **lack of formal guidelines** and governance mechanisms that SOAs typically have to cope with. However, cases exist where providers of Web-based platforms have been enforced to review the content they publish [2] which may have considerable impact on future Web 2.0 business models. As opposed to most Web 2.0 applications, **SOAs are subject to clearly defined regulatory frameworks** (e.g., the Sarbanes-Oxley Act) since they mostly exist in the corporate context. Design, provision, maintenance and the coupling of services must be compliant to legal frameworks and thus do not allow for flexibility as observed in the Web 2.0 context.

4. The Internet of Services and its impact on inter-organizational collaboration

4.1. Convergence of Web 2.0 and SOA towards an Internet of Services

This analysis has revealed significant differences between real-world Web 2.0-and SOA-applications which mainly arise from their different contexts. SOAs need to be subject to strict governance processes in order to reliably serve a corporation's needs, whereas Web 2.0-applications are mainly devoted to integrating as well as interlinking individual end-users and providing them almost unlimited possibilities to involve themselves into creating, mashing up and sharing content or functionality in the Web. However, as described above, Web 2.0 and SOA-applications do share common ground with regard to numerous central principles.

Very recently, an increasing number of use-cases demonstrate the great potential of combining technologies and design principles of both Web 2.0 and SOA. **Data Mash-ups** (as opposed to mere content Mash-ups) are currently emerging as first, more technically advanced applications of the well known Web 2.0 Mash-ups [1, 2] and can be considered as situated at the interface of Web 2.0 and SOA. For example, the firm *Applibase Inc.*[4] enables users of its platform to leverage the REST- based application interface of *Amazon* to search for books and connect this with arbitrary other applications that clearly expose business functionality (e.g. a search interface for other book inventories). The interconnection of presentation-layer focused Web applications to internal SOA implementations may be of significant value for enterprises as the reach of their services can be extended onto the Web for further use and composition by their business partners and customers.

The firm *Kapow Technologies*[5] has recently published its vision of so-called **Enterprise Mash-ups**. It focuses on empowering users of their *Web Integration Platform* to integrate resources available via the Web on several different levels of complexity and thus efficiently realize rapid portal creation, content migration, synchronization and syndication as well as cross-enterprise application integration and SOA enablement in a professional corporate context. Rather than limiting application development or customization to sophisticated developers, business experts are enabled to take application functionality available via company portals in the Internet and compose it according to their current needs on the basis of a merely visual, technology-and complexity hiding modeling interface. This approach clearly combines technologies from the fields of Web 2.0 and SOA (e.g. AJAX, SOAP-based Web services, RSS, REST). It also builds on the underlying principles of both worlds. The platform integrates individuals via a rich user interface, allows for free composition of resources but also bridges the gap to more "heavyweight" back-end services that usually reside on a merely technical level.

Besides these first examples, the combination of technologies and design principles of both Web 2.0 and SOA may drive the emergence of an **Internet of Services (IoS).** This next-generation form of Internet may be described as a global platform allowing both end-users and businesses to seek, combine, customize, use and publish interoperable resources. In this IoS (see Figure 2), the basic principles of ***SOA*** such as the loose coupling of resources via uniform interfaces, choreography and composition for the definition of higher level processes as well as the publishing and retrieval process via central registries will act as crucial

[4] http://www.datamashups.com/
[5] http://www.kapowtech.com/

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foundation. However, they will be enriched by the incorporation of numerous elements from the field of ***Web 2.0*** to improve the visibility and usability of Web-based resources (be it content or application functionality) through human users. Folksonomies will emerge that serve users as indicator of different resources' quality and particularities. "Gadgets" will be developed by various resource providers to make their services comprehensible and usable by humans. Traditional Web Services are encapsulated based on the WSDL standard, which cannot be easily interpreted or used by individuals with only low IT sophistication. By offering gadgets that explain the underlying service's functionality in an intuitive and rich way, a face is put on those Web Services, thereby facilitating their acceptance and usage.

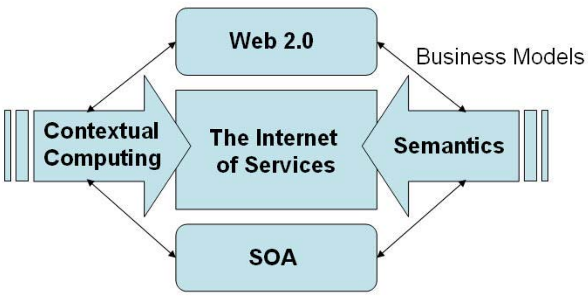

Figure 2: Web 2.0, Contextual Computing, Semantics and SOA as major building blocks of an Internet of Services

Contextual computing will play the role of a further building block for the Internet of Services. This discipline aims at developing systems incorporating awareness of and the ability to adapt to contextual information about users and their respective environments with the goal to enhance their usability and scalability. Currently, technical applications frequently behave the same way regardless of whom and where the user is or what he is actually doing. The Internet of Services is expected to provide users the resources which currently fulfill best their needs in a proper and personalized fashion and thus will require a widely accepted way to formally represent and process contextual information.

The widely known concept of a ***Semantic Web***[6] aims at augmenting the existing Internet by machine-readable semantics, making the content of today's Web accessible to intelligent queries and machine-reasoning. Additional, formalized pieces of information attached to resources will describe content, meaning and relations in order to enable their evaluation and processing by machines. The Internet of Services will leverage this concept and integrate it towards better and improved usability for human beings. The interconnection between user-generated, light semantics (often referred to as folksonomies) and more heavy-weight, formalized ontologies represents a first step into this direction.

Besides the four technical building blocks, the establishment of a successful ***business ecosystem*** of resource providers, intermediaries and consumers will play a relevant role for the fast emergence of the Internet of Services. Existing business models will be turned upside down as the whole Web is expected to act as a platform for building and consuming resources.

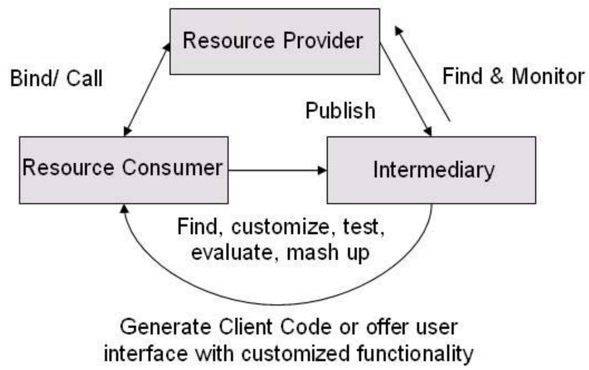

Figure 3: New Intermediaries with rich functionality

New and currently already emerging ***Intermediaries*** represent a central enabler for the Internet of Services as described above. As visualized in Figure 1, the traditional SOA-concept relies on central registries enabling users to retrieve Web Services that match their requirements. In this context, UDDI is widely accepted as standard and offers a platform-independent, XML-based registry specification for stakeholders worldwide to list and find required services via the Web. However, the UDDI standard aims at technical experts and only specifies very limited functionality. Merely UDDI-based registries are not adequate to serve the large number of normal Internet users who require intuitive, human-readable interfaces to identify and to evaluate existing services and to finally integrate and mash them into their applications. As depicted in Figure 3, novel forms of intermediaries do not only contain references to services, but also offer statistics about resource performance or information about evaluations conducted by previous users.

The typical resource discovery and utilization process is therefore different from the one depicted in Figure 1. A resource provider first of all publishes a reference to his resource at the intermediary which stores it and subsequently starts to monitor parameters

[6] http://www.w3.org/

such as general resource availability and response latency. Potential consumers may then access the intermediary's Website and use the performance metrics and other, user-generated evaluations while searching for adequate resources. Some intermediary platforms even provide users intuitive interfaces that allow for mashing up resources without any programming efforts. Others, such as the intermediary **WebRPC**[7], for example, are able to create customized code which can easily be integrated into individual Mash-ups. The WebRPC platform operator therefore uses the advertising slogan "Find, customize, monitor, and call SOAP, REST, or HTML services in minutes".

The emergence of such intermediaries that act as central resource publishing and management platforms in an Internet of Services can be motivated with help of **institutional economics**. According to North [14], the reason for institutions to exist is the uncertainties involved in mutual interaction of agents; institutions act as framework to constrain and structure that interaction and make it more reliable. The proper establishment and application of informal constraints, formal rules and enforcement mechanisms are adequate to lower transaction costs and boost economic performance. Intermediaries such as the WebRPC platform are recognized as trustworthy central points of access to different kinds of Web-based resources. By monitoring performance and by gathering user-based evaluations, they lower the risk for new users to select a bad performing resource for their Mash-up. They also act in a normative fashion as they provide common standards for publishing resources. In this way, resource interoperability is facilitated, thereby again lowering transaction costs involved in the electronic interaction of agents.

4.2. Implications for cross-organizational collaboration

Future work will be devoted to thoroughly investigating the impact of an Internet of Services on the collaboration of organizations. This section introduces transaction cost theory as a methodological foundation for the analysis and provides a first elaboration on the dimensions of this change.

Nowadays, the transfer of physical goods/ services between organizations is hardly possible without the exchange of information. Such inter-organizational information transfer is still frequently being performed by humans on the basis of rudimentary communication means such as e-Mail or telephone (see Figure 4). In this way, *many* partners can quickly be reached without requiring significant effort for agreeing on and setting up specific system connections and information exchange technologies. To increase the **richness** of information exchange, firms mostly have to accept the reduction of **reach** [15]. Electronic collaboration between firms can be automated with the help of EDI or Web Services technology, but involves significant technical complexity and the effort of agreeing on common messaging protocols and semantics, to name only a few. By putting up with a loss of reach (it is hard to reach an agreement on a common technological foundation for electronic business transactions with numerous different transaction partners), organizations achieve an increase of richness: Web Service-based cross-organizational interconnections promise to seamlessly integrate heterogeneous systems, to reduce errors stemming from manual interventions and to allow for efficient and high-volume business transactions.

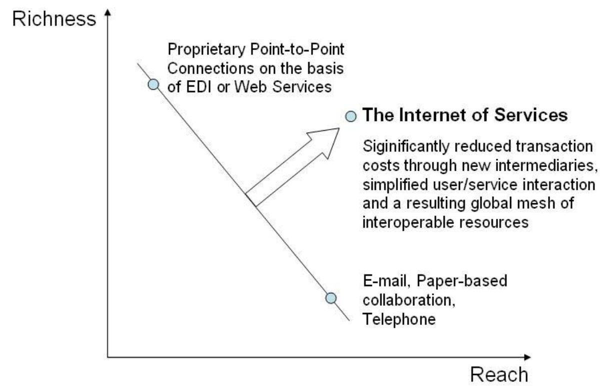

Figure 4: The Internet of Services increases both richness and reach of IT-supported cross-organizational collaboration

This trade-off can be explained on the basis of **transaction cost theory**. According to Williamson [16], the following factors represent the main drivers of the costs incurring from transactions between individual agents: *Bounded rationality* (human actors have only limited capability to decipher their environment), *uncertainty* (future developments of the environment cannot reliably be predicted) together with *opportunism* (potentially selfish behavior of actors) and *asset specifity* (describes the fact that transactions may require investments in durable, transaction-specific assets in order to support their execution) induce significant costs in the transaction of goods or services. Such costs do not only arise in the context of exchanging goods or services, but also when transferring information. The **uncertainty** involved in defining common messaging protocols or semantics as well as the high investments (**asset specifity**) necessary for the setup and maintenance of information system that are possibly only used for one single bilateral

[7] http://www.webrpc.com/

interconnection (thus have limited scope) represent some of the drivers of high transaction costs in electronic cross-organizational collaboration. As a consequence, companies often face the trade-off between richness and reach.

In the **era of an Internet of Services, this trade-off will no longer exist**: First, resources may be published, retrieved and consumed in an interoperable fashion. The above introduced intermediaries will facilitate resource interoperability and thus reduce the uncertainty involved in connecting today's heterogeneous corporate information systems. Apart from that, the integration of externally provided resources will be simplified through the use of platforms with rich functionality allowing business experts to mash resources without requiring major programming efforts. In this way, asset specifity is heavily reduced as well. Richness and reach of electronically supported, cross-organizational collaboration will be enabled by the Internet of Services simultaneously: Information systems of organizations can be connected to automate high-volume and complex business transactions, while the reach of such interconnections is less limited compared to state-of-the-art technologies.

5. Conclusion

In this work, we thoroughly compared the two concepts Web 2.0 and SOA from a technical and economic perspective. Numerous similarities, but also clear differences have been identified in each of the seven criteria for comparison.

Recent applications show the paramount importance of unifying the two concepts to drive the next wave of value creation within and across enterprises. By integrating the business user into enterprise application design and maintenance, IT can be aligned to actual requirements more quickly and efficiently. A combination of Web 2.0 and SOA paradigms and technologies is expected to facilitate the emergence of the Internet as a global platform for publishing, retrieving, mashing and using resources in an interoperable fashion which we refer to as the Internet of Services. This new kind of Internet will heavily reduce the costs of transferring information between enterprises and will thus simplify and speed up electronic cross-organizational collaboration.

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