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Standard for ERP as Cloud Computing

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ABSTRACT

In the last years, Cloud computing for ERP systems provided solutions to the problems and difficulties encountered by conventional ERP systems. Many companies are evaluating the promised advantages and considering making use of cloud services. There are a lot of discussions about the role of standards in Cloud Computing. This research tries to investigate how beneficial it is to use standards for cloud computing to help organizations implementing ERP systems with less implementation cost and time. In this study we interviewed both ERP suppliers and buyers for their opinion about standard for ERP as a cloud computing. Interpretive research used to interpret what interviewees said and in what context to get a better understanding of the collected data. Most of the interviewed customers agreed about the benefits they may gain from such a standard and considered it theoretically and financially very feasible for them. Many ERP as service providers may not agree with an easy standardized interoperability mechanism, which will give total freedom to ERP on-demand clients to change providers easily. The proposed solution is to standardize the core functionalities of ERP as cloud service, where ERP as cloud service providers might provide basic standardized core functionalities, and can offer any distinction customized functionalities on the top of that core. This way, customers will have standardized interoperable solutions and providers will still have more option to compete with price and features.

Keywords: *Enterprise Resource Planning (ERP), Cloud Computing, ERP standard*

1. INTRODUCTION

Enterprise Resource Planning (ERP) may be defined as business management software that allows an organization to use a system of integrated applications to manage the business. Information is the most valuable asset for enterprises; it helps the companies keep track of their business, customers and stakeholders. Many systems were developed to organize and manipulate this information. [01] For that reason, many organizations turned to use some kind of ERP systems over the past few years. Enterprise Resource Planning (ERP) systems considered as the core of successful data, information and knowledge management, which brought a new way of processing and delivering operational information, which enabled organizations to integrate their business functions, and access real-time, up-to-date consistent data. The significant improvement resulted from using ERP systems emerged it as a vital tool for most of the organizations. [02][03] ERP systems integrate the various firms' departments through different business functions to manage the internal resources such as finance, human resources (HR), manufacturing and logistics, and link the firm with the customers and vendors through Supply Chain Management (SCM) and Customer Relationship Management (CRM). ERP systems have evolved to become one of the largest IT investments for many companies during the 1990s. [01]

ERP systems offer the market with many features and advantages introduced through an easy to use, real-time, decision support system, which integrates all organization's functions into one system with single database that can be accesses by suppliers and customers to get timely react regarding their needs. However, despite the huge benefits of ERP systems, there are some shortcomings raised due to the huge amount of resources required for the implementation and big risk of failure, which introduced difficulties prevented small and mid-size organizations from setting up ERP systems. ERP system is a costly and time-consuming system to implement, and enclose high risk of failure and disruption to the customer's business continuity process. As ERP systems emerged as a vital tool for many organizations, these difficulties demanded the researchers to search for a new way to implement ERP applications.

In General, there are many discussions about the role of standards in Cloud Computing [04]. Standards in Cloud Computing has two groups, the first group sees the Cloud Computing completely new that requires new set of standards. Other group see the Cloud Computing as a technology that is based on existing technology that already have standards. This research tries to investigate how beneficial it is to use standards for cloud computing to help organizations implementing ERP systems with less implementation cost and time.

2. CLOUD COMPUTING BASICS

Cloud Computing refers to a model that deliver its offering and its special services over the Internet. These services can be Software, Hardware, Platforms, Services, Networks, Storage Providers, Servers, Services and etc. There are different companies like Apple, Google and Amazon that provide cloud computing services. The cloud computing can
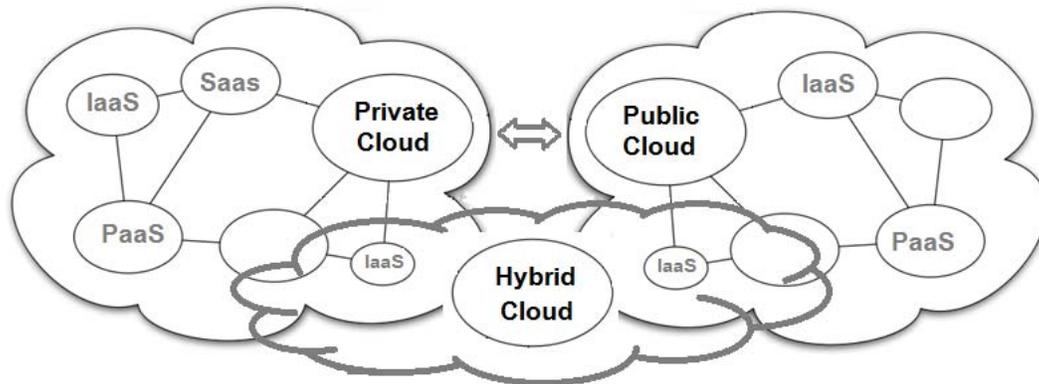
Fig 1 Cloud Computing Types

be categorized as Public Cloud, Private Cloud and Hybrid Cloud as depicted in Fig – 1.

- **Public Cloud Computing**: In this model the infrastructure of cloud computing (applications, storage, and other resources) is owned by an organization selling cloud services and it is made available to the public. Amazon AWS, Microsoft and Google are public cloud service providers. They own and operate the infrastructure and offer access only via Internet Users can access this service by web browsers.

- **Private Cloud Computing**: The cloud infrastructure (hardware and other IT resources) are operated for a single organization. It may be managed internally by the organization or by a third party. It may be hosted internally by the organization or externally.

- **Hybrid Cloud Computing:** The cloud infrastructure is a composition of two or other clouds computing structures (private, public). Hybrid Cloud Computing managed and provisioned as a single unit and circumscribed by a secure network [05].

Cloud services are provided in three services (Fig-1):

- **SaaS** (Software as a Service) - probably the most popular form of cloud computing and are easy to use. It delivers software as a service over the Internet, eliminating the need to install and run the application on the customer's own computers and simplifying maintenance and support. The Google APP and Apple Cloud are example of such service, and can be accessed by browsers or client software.

- **PaaS** (Platform as a Service) - It delivers computational resources through a platform and considered the most complex of the three. PaaS is a framework they can build upon to develop or customize applications. PaaS makes the development, testing, and deployment of applications quick, simple, and cost-effective. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, eliminating the need to buy the underlying layers of hardware and software.

- **IaaS** (Infrastructure as a Service) - refers to the cloud service model that provides on-demand infrastructure services to the customers. The infrastructure may refer to rentable resources such as computation power, storage, load-balancer, and etc. Customers do not purchase software, servers, or network equipment. A third party allows users to install a virtual server on the IT infrastructure of IaaS Could Computing.

3. RELATED WORK

There are several works and numerous research initiatives that deal with Cloud Computing ERP. Cloud-based ERP systems offer a number of advantages over traditional systems. [07] There are several projects related to cloud computing standardization [08]. Some of these projects focus on standardizing parts of a cloud computing solution such as authentication, Interoperability, Cloud Storage, workloads, cloud services and data access. Other efforts focus on standardizing how the parts should work together as a solution. The Cloud Standards Coordination Wiki maintains a list of some of these projects [09].

Schubert and Adisa's work is an attempt to find the impact that Cloud Computing might have on the way standard ERP systems are operated. They developed a reference framework for cloud computing providing terms and definitions for the IS research. [10]

Lewis, points that one of the problems with cloud standards is that there are too many standardization efforts. Cloud standardization efforts should focus on finding common

representations of user identity, workload (virtual-machine images), cloud-storage APIs, and cloud management APIs. These standards will potentially enable the dynamic third generation of cloud-based systems, but only business needs will motivate and determine this evolution.. [11]

This study paid a special attention to the role of standards by investigating the possibility of achieving a standard to apply ERP as cloud service that might be defined technically and accepted organizationally. This research spanned from studying the knowledge base in this area, interview the suppliers and buyers base, and analyze and compare the interviews results with the theory to bridge the gap between theoretical and practical point of views.

4. RESEARCH FRANEWORK

This paper investigates the role that cloud computing might have on the way standard ERP systems are operated. This research is an exploratory study consisting of available literature review and discussions with key practitioners and researchers and interviews data analysis. We performed a review of the academic literature in order to identify the related studies to standards for cloud computing in general and Standards for ERP as cloud computing in particular. This helped us to analyze interviews data and issues for standards ERP as cloud computing.

This section outlines a process of assessing evidence that asks questions related to important aspects of interpreting research findings. The research framework provides a sound methodology for reviewing standards for ERP to determine whether these standards can be considered in cloud computing. This research framework served as the basis for establishing standards for the review of the evidence to ensure that the standards are evidence-based and practical
In this study we interviewed both ERP suppliers and buyers for their opinion about standard for ERP as a cloud computing. Interpretive research used to interpret what interviewees said and in what context to get a better understanding of the collected data.

The product of this research was an intersect between the available relevant knowledge, and the market, where some market representatives were interviewed to bridge the gap between theoretical and practical point of views, and get deeper understanding regarding issues and features of ERP as cloud service. The purpose of this research was influenced by the potential benefits of using cloud computing technology to implement ERP systems with less time, cost and failure risk consequences, and how achieving a standard for ERP as cloud service could ease ERP implementation and reduce required resources from both customers and vendors. The analysis framework was based on the combination of theoretical base, our own expectations, and the interviews results from the two markets representative (suppliers and customers).

4.1 Source and Time Frame Selection

In order to discuss the standards for ERP as Cloud Computing, we first need to define and understand what exactly the standards for ERP and cloud computing are. For this, we developed a reference framework of underlying terms

and concepts related to Cloud Computing Standards. With the help of this framework, we selected cloud standards that can affect the ERP systems. Based on these information and our own investigation and observations we then propose an interview for "Standards for ERP systems as cloud computing".

The survey made over the telephone with a representative person from the interviewed company. The interviews were varied on time, between 30 – 90 minutes depending on how excited were the interviewees about the idea, and were willing to share much more information. All the interviews were recorded and reviewed after the interview for deeper study and further investigation and analysis. The interview questions were designed to be easy to answer by phone, fit with the time, and get as much information as possible from the interviewees. However, not all the conducted interviews were the same, as not all the participants showed the same excitement to contribute in the study. As well as the different ages and backgrounds affected our interpretation for the interviewee's attitudes and views toward the investigated issues, which had main influence on the final results of this exploratory study. The parties that need to be discussed when looking at Standards for ERP as a cloud computing are consumer and suppliers The interviews are summarized in the Table -1: [07]

Table-1 Summary of the interviews

Role	Company	Country	Interviewee position	Dura tion
Supplier	Lawson	Sweden	VP & Product Management	50
	Medius		Regional Manager of After-sales	50
	SYSteam		Product / Marketing Manager	40
Consumer	Bejoken	Sweden	Product & IT-Manager	60
	Eldon		CIO	60
	Sapa Group	UK	MIS Manager	30
	SAS Tech AB	Sweden	CIO	90
	Cloetta		IT Manager	45

4.2 ERP Standards

Usually information systems built up by different components from different manufacturers using different production and business models. When you are selling one component of a whole system, you cannot compete if your component not compatible with the rest of the system. Here comes the importance of standards principles. [12] ERP is a modular system, where different ERP products are available in the market from different vendors with many different varieties. To have a standard that supports the ability of using modules from different vendors, integrate them together as one system will have great value for the customers. [07]

Customers lock-in and switching cost are the main drivers for developing and adopting standards. [12] ERP is a crucial system for many organizations, but its high cost and long term implementation are troublesome concern for many customers, despite the great profit in time and money they could gain by implementing the system, the failure risk is still high and costly. [02][13] Even if the company took the risk and implemented ERP system, it is very unlikely to change it in the future and go through all the risky and cumbersome processes again. [14][15] This high switching cost, in addition to the risk of a substantial disruption in operations, and probability of data are unlikely to transfer perfectly between the two ERP systems, made the corporate information officers (CIOs) think long and hard about changing ERP systems. [15][16] ERP systems high switching cost lead to lock-in problem, which can be a source of headache or substantial of profit, depending on weather you are the one who locked in, or who hold the key. [12] Switching cost is the normal case in information industries. Customers cannot avoid lock-in, but the essence of lock-in is that your choices in the future will be limited by your investments today. Customers must do exhaustive research and feasibility study before deciding to implement ERP system, including what modules needed, how many licensed users, and from which vendor. [15] All this and more customer's side must take serious care of before do any step ahead through the ERP implementation process. Once the ERP implementation process started, there is no go back, and any mistake will cost the customer lots of money, and delay the system to go live, in addition to the risk of a substantial disruption in the client's daily operations. [15]

Standards enhance compatibility, interoperability, and generate greater value for users. If a standard is truly open, consumers will be less concerned about being locked-in. [12] ERP standard will help customers to mix and match modules from different vendors and create a unique, cost-efficient solution, instead of having to acquire the all enterprise from single vendor. [17] However, this is far from the case nowadays, and still dependent upon decoupling the enterprise system into interface-ready modules, which means the ERP platforms need to be re-engineered and lots of time and resources required from vendors to enhance their ERP packages. [02][17]

5. SEEKING STANDARDS

Introducing new products and technologies, firms might face a fundamental trade-off between openness and control, firms either choose an open approach by offering the necessary interfaces and specification available to others, or attempt to maintain control by keeping system proprietary. Technologies that are made open are more likely to gain popularity, but the rewards from such success are far greater for companies that can retain control over the use and design of its technology [12].

As clouds become more popular, the IT world will be filled with clouds that offer different computing services. Will these clouds be treated individually as separate stand alone services, or open standards will emerge to allow all different clouds from different providers to interoperate with each other?. Standard might allow customers to build cost efficient,

compatibility, and interoperability ERP solutions by mix and match interface-ready modules from different vendors into the same cloud. [17] Interoperable standard relies much on the need of well-defined standards inside and between clouds. To reach such a promising standard, the market must overcome many challenges, as no widely accepted common cloud definition or standards had a foothold in the market yet. The situation today that there is no ideal cloud infrastructure exists that would support interoperability. Cloud service providers have their own way (APIs) on how a user and cloud interacts and how clouds interact together. [18] This adds limitations to the cloud choices due to the risk of being locked-in, and the lack of data portability, as clouds are treated individually. [19] To address the challenges of cloud computing interoperability, several standards groups are developing specifications and best practices to enable cloud interoperability, like Open Cloud Consortium (OCC) which tries to support development of open standard for cloud-based computing, and develop standards and interfaces for interoperation between various types of clouds. [20] Open Cloud Manifesto as well provides a minimal set of principles that forms a basis for initial agreements as the cloud community develops standards for this new computing paradigm. [21] and Cloud Computing Interoperability Forum (CCIF), which is planning to come up with a unified cloud interface as a try to unify various cloud APIs and abstract it behind an open and standardized cloud interface.

However, many ERP as service providers may not agree with an easy standardized interoperability mechanism which will give total freedom to ERP on-demand clients to change providers easily. Moreover, ERP as service providers might tend to offer differentiated services from other vendors to get a better competing position and attract customers, but such a common standard may take this away from them. For these reasons, the proposed solution is to standardize the core functionalities of ERP as cloud service, where ERP as cloud service providers might provide basic standardized core functionalities, and can offer any distinction customized functionalities on the top of that core. This way, customers will have standardized interoperable solutions and providers will still have more option to compete with price and features. [20] On the other hand, despite that the idea of having ERP as cloud service standard that supports interoperability is theoretically feasible, and could give the customers more freedom in choosing their preferred vendors and modules, in addition to potential cost saving. Practically, there is no proof about how feasible actually the standard will be, and how likely that the collection of modules customers are trying to match in the cloud are truly interoperable.

6. STANDARDS FOR ERP AS CLOUD COMPUTING

A standard for ERP as cloud service might be beneficial for customers and small vendors, but may not be welcomed by big vendors. [12] [15][17][20] [22] The differences between the vendor's views about their support for ERP as cloud standard considered reasonable, as both smaller vendors would support and welcome such a standard, while Lawson does not believe in such a standard. However, when looking at the benefits and losses from an ERP as cloud service standard

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for the three vendors, at Lawson they might look at the standard in negative way as they would lose their market share, and have to compete with other vendors for their market share and customers. But for small vendors like Medius and SYSteam the situation is different. Medius might benefit from the standard by providing their ERP service complementary for other vendors offerings, which may open wider market for their workflow streamline invoice management system. While for SYSteam such a standard might have a negative outcome for their offering, as SYSteam does not offer a differentiated service for the customers. However SYSteam situation considered plausible as no sign in the market for an ERP as service accepted standard that will allow customers to implement the modules their like from the vendors they prefer easily and cost effectively by their own not even in the near future due to the low maturity level of ERP on-demand in the market. So the SYSteam role as integration assistance might still have market until such a standard get a foothold in the ERP market.

Moreover, it was expected and reasonable that most of the interviewed customers would support a standard for ERP as cloud, but with different views varied from positive view about the possibility of achieving it, to doubts if this would be possible in the future. As well most of the interviewed customers agreed and would support the possibility to use modules from different vendors in the same cloud. However two of the customers thought that such an option will not add great value to the market, as they prefer to have the modules in the cloud from one supplier. This forsake opinion toward using modules from different vendors in the same cloud might be for two reasons derived from analyzing the customers' responses,

first, it would be less risky to have all modules in the cloud from a single vendor, because modules from the same vendor might integrate and operate better with each other as single consistence system. Second, because of the support issues in case of problems, who will have the responsibility of the support issues, as they expect that vendors would just point at each other if something malfunctioned? On the other hand some customers don't believe such a standard would be impossible to achieve, and even if it is achievable it will not add great value to the market.

Even though most of the interviewed customers agreed about the benefits they may gain from such a standard and considered it theoretically and financially very feasible for them. The vendor's split views toward a standard, and as long as big vendors would not drive and support the researches toward the standard, no ERP cloud services standard would gain foothold in the market. Unless an alliance group would be formed to lead the researches with the support of the customers. This may force the big vendors to support the researches rather than being left behind. [17][20]

7. CONCLUSIONS
In this research we collected and analyzed views of different ERP vendors and buyers toward the possibility of achieving a standard to apply ERP as cloud service. Based on the literature survy ans conducted interviews and our data analysis we can summarized results of our study as following:

- Smaller vendors would support an ERP as cloud service standard; however, bigger vendors didn't believe or welcome such a standard. And most of the interviewed customers would support a standard for ERP as cloud, and agreed about the benefits of having such a standard.
- It was expected that customers would have supportive views toward a standard for ERP as cloud, and the integration possibility with on-premise software, but this was not the case, as some customers didn't see the benefits of these features, and didn't believe they would add value to the market.
- The proposed solution is to standardize the core functionalities of ERP as cloud service, where ERP as cloud service providers might provide basic standardized core functionalities, and can offer any distinction customized functionalities on the top of that core. This way, customers will have standardized interoperable solutions and providers will still have more option to compete with price and features.

There are many many external factors may affect the validity of our results like personal experiences, different contexts, or bias for their own firms, age, position, and social background. Furthermore, the variation of the views between the suppliers' and buyers', as well as between the suppliers' views, and the buyers' views was driven by the following potential reason, we can brief that by sating that ERP on-demand (ERP as cloud service) market is not matured enough, as there is no ideal accepted definition on the market for it, in addition to many debates about the service requirements, advantages and shortcomings.

An alliance group that might drive the researches toward an ERP as service standard might be a goal for the market to achieve.

Finally, as introduced in this study cloud computing likes any other technologies trends, abandoned at the beginning, but as time pass, it will become real, which is something has to do with the normal evolution.

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