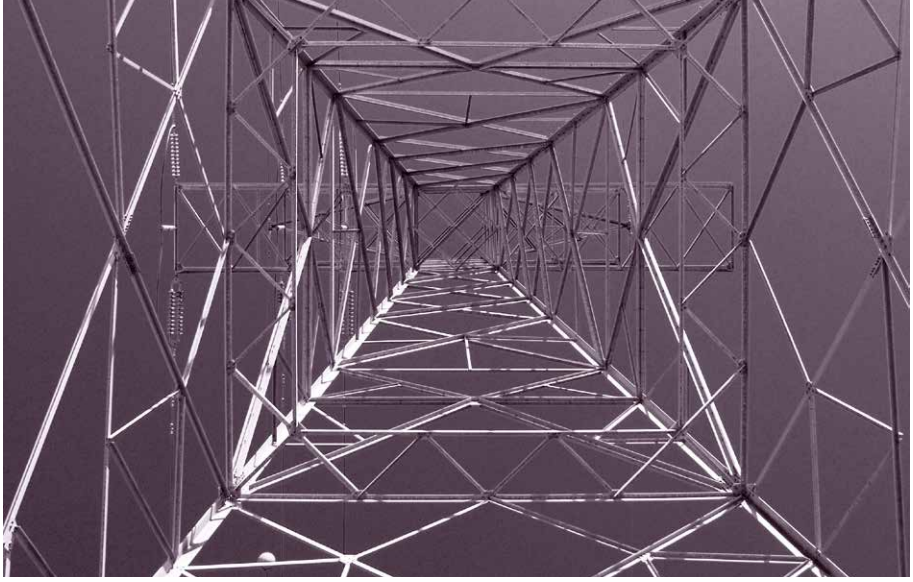

ERP in the Cloud

Sebastiaan Eilander and Tijs Willebrands

The cloud offers opportunities for various IT services, including the support of business processes or, in a broader sense, Enterprise Resource Planning (ERP). This article describes the way in which on-premise ERP is related to the so-called "cloud," the advantages and disadvantages of ERP in the cloud, and the considerations that must be reviewed before taking a trip into the skies.

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Introduction

In the past few years, organizations have seen many information systems and IT services relocate to the cloud. Cloud computing has now surpassed hype status, and is developing to maturity. The (proven) benefits that the cloud offers are encouraging more and more organizations to move the IT elements of their business processes to the cloud, following in the footsteps of their general software applications such as GoogleDocs and Office365.

Besides the most important reason to switch to the cloud – the lower costs (see also [KPMG13]) – there are also benefits in the frequently promoted usage and subscription model, the "obligatory" compliance with standard processes, and the connectivity. On the other hand, however, organizations are also questioning the safety and security of the cloud, its performance, and the possibility of changing suppliers.

Due to the current economical pressures and the fast rise of cloud computing in the ERP domain, it is becoming increasingly difficult for those responsible for ERP strategy within an organization to make the right choices.

This article describes the current state of affairs with regard to cloud-based ERP and the associated deliberations that organizations must take into account in their decision-making when they are considering switching to ERP in the cloud.

The service models for cloud computing offer a whole stack of services

Cloud computing and ERP

Software is traditionally put on the market in the form of an on-premise model. In this model, the organization itself is responsible for the management of the software and hardware at its own location. This mode of operation has been supplemented by the use of external services offered by third parties at external locations, with only client software being installed at the client's own location. In the model of cloud computing, third parties offer data and systems as services, often web-based. Nowadays, cloud computing is no longer a new phenomenon and the expectation is that the market for cloud computing will continue to grow in the coming decade. Despite the hype and the related attention it has received in the past years, cloud computing still needs additional explanation, specifically to clarify the translation from cloud service and deployment models to ERP systems.

Essence of cloud computing

Services that are offered with cloud computing have their origins in two important technological developments: the multi-tenancy concept and virtualization.

- Multi-tenancy ([Schu11]) is the shared use of a software program (and corresponding code) by several parties, each of which makes use of its own individual data space.
- Virtualization ([Schu11]) is the physical sharing of hardware capacity (machines) by allowing virtual machines to function side-by-side on shared hardware.

These specific features that apply to the origins of cloud computing provide ways of categorizing cloud service models.

Service models

The service models for cloud computing are based on the above-mentioned virtualization and multi-tenancy. The service models offer a whole stack of services (infrastructure, platform, software). These are known as IaaS, PaaS and SaaS, and are outlined below in the context of ERP.

- With *Infrastructure as a Service (IaaS)*, an organization draws computing resources (processor and storage capacity) from a cloud provider. The organization can run and use existing ERP software and licenses on this infrastructure. This form is similar to the previously mentioned hosting by third parties, but offers advantages due to the fact that the computer resources are provided in a scalable format, with a usage or subscription model. Major service providers are Amazon and Rackspace.
- We speak of *Platform as a Service (PaaS)* when an organization makes use of computer resources in a predefined software environment. These predefined environments are very attractive for the development, testing and distribution of software. With regard to ERP, this is a service model that ERP suppliers can use to develop their ERP systems in these environments. The Windows Azure platform created by Microsoft is an excellent example of this.
- *Software as a Service (SaaS)* is useful if the cloud provider offers both the infrastructure and the ERP system that runs on the infrastructure. In this scenario, the roles of software supplier and cloud service provider are combined. Access to ERP happens via the internet. An example of this is SAP with BusinessByDesign, but smaller suppliers such as TBlox and Compierecan also be found in this market.

Deployment models

There are two deployment models available to an organization that is considering cloud computing. These are known as a "private" or a "public" cloud. In both models, the services are made available from an external location. In a private cloud, however, these are exclusively available to one organization, whereas they are available to several organizations in a public cloud. In the public cloud, organizations do actually make use of the same software (including source code) but are individual tenants of the software.

Figure 1 shows the service models and deployment models combined. To make the best use of the cloud for ERP, we should examine the SaaS possibilities, as this is the area where ERP functionality is actually provided, in combination with the benefits of the usage- and subscription models associated with this option. We shall also focus on the public cloud, where we can gain advantage from true multi-tenancy because these ERP systems are offered to several organizations in the same way. ERP in the cloud, as we approach it in this article, is thus situated in the upper right-hand corner of the Figure, where it enjoys the benefits of the comprehensiveness of the service stack (infrastructure, platform and software) and the benefits of scalability (virtualization and multi-tenancy).

Cloud deployment models

Private cloud: a facility in a cloud-computing environment based on a collection of physical servers that are deployed and dedicated exclusively to one specific client, and hired on request.

Public cloud: a facility in a cloud-computing environment based on a collection of virtual servers that enable various clients to share physical hardware. In this outsourcing model, the client hires the virtual server on request.

Between the private and the public cloud there is another variant: the *hybrid cloud*. In this case, people make use of a combination of private and public clouds. By configuring one application as private and the other as public, an organization can eventually realize a hybrid cloud. But it is not possible to realize a hybrid cloud in the context of ERP, which is a fixed system and offered in either the private or public version.

Impact of the cloud on ERP systems

Because ERP systems support all the core processes of an enterprise (including financial business operations) and are the source of the most important master data for the entire business operation, the decision to go with ERP in the cloud should be given serious thought – perhaps more consideration than is typically given to stand-alone applications. In the formulation of the ERP strategy, an organization should make the decision between on-premise software and the cloud on the basis of the following considerations:

Costs

Cloud-based services, and therefore also cloud-based ERP, are offered in the framework of a subscription model. No prior investment in software and hardware is needed with cloud-based ERP implementations, because the software, hosting (infrastructure and WAN) and support services are provided on the basis of a subscription and/or usage gauge. The operational costs and initial investment are thus lower than with traditional ERP systems. Besides the subscription model, the costs are also generally lower

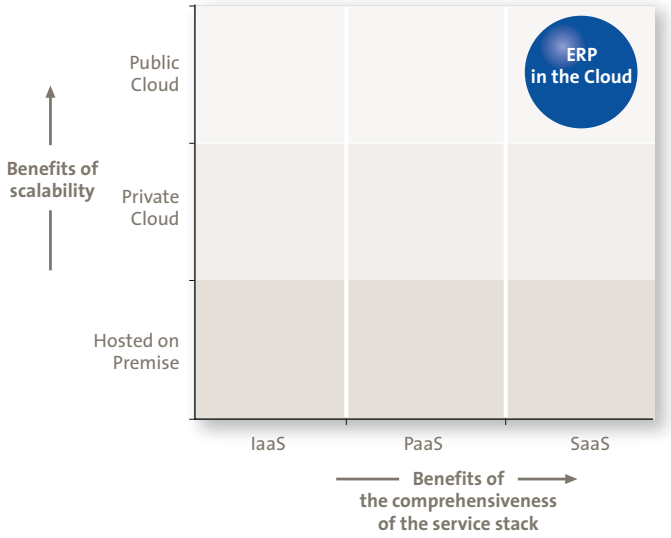

Figure 1. **Service and deployment matrix of cloud computing.**

because cloud providers can make use of scalability (virtualization and multi-tenancy). Such benefits are most attractive to small and medium-sized businesses. Multinationals with shared service centers in low-wage countries have already realized sizeable cost-savings in this field.

Finally, with cloud-based ERP, the effort expended in the implementation and lead-time can be significantly reduced, in line with the substantial decrease in the complexity of the implementation. This results from the standardized functionality with which the client must comply. Please note, nevertheless, that the organizational adaptations must be minimized in order to avoid neutralizing the cost benefits.

A business case must validate a decision in favor of cloud-based ERP. In a good business case, the costs are calculated over the long term (15-25 years) in order to find out how the one-off costs are related to monthly expenditure. Where costs are calculated on the basis of transactions such as incoming or outgoing invoices, this expenditure must also be included in the business case, with realistic upper and lower boundaries.

Interfacing

ERP is the throbbing heart of the organization and connections to other systems are of crucial importance to guarantee consistency and efficiency. When an organization places ERP in the cloud, it must investigate the possibilities of realizing links to and from the cloud solution.

Standards for data exchanges exist in the form of XML, for example, but often involve "dialects." There are several providers that offer a standard interface. Other providers offer fewer possibilities in this area.

Consequently, integrating applications from different providers creates a risk; one that IT architects should assess before advising with regard to the choices between cloud solutions. Complex IT landscapes and interfacing with different tailor-made packages probably cannot be realized for standard cloud solutions. The transition to this kind of solution, therefore, is not really feasible for large(r) parties that run a multitude of (existing) applications.

It is important to inventory the existing interfaces and to determine the (im)possibilities of linking up to a cloud solution.

Data security and privacy

Storing sensitive information beyond the controlled IT systems of the organization requires much precision, and also demands careful consideration of the risks and (the interpretation of) the relevant regulations. For example, we see that in the healthcare sector, patient data is generally not stored outside the on-premise IT systems of the health institution. There are also various organizations that are required by (local) law to store their data in the land of origin, or even within the organization itself. For more details on these specific topics, we refer the reader to previously published articles ([KPMG11][Chun10]).

Based on the organization's information security policy and the translated requirements onto the IT architecture and applications, managers have to review the risks of moving to a cloud solution. It is also possible to minimize the risks by expressing them as requirement to the cloud provider. A well-known requirement is, for example, that the data center should not be located in the USA because the American government would then be entitled to request access to the data on the basis of the *Patriot Act*. For such reasons, many cloud providers offer a data center in each continent. It will be self-evident that current laws and jurisprudence should be taken into account.

Organizations are well advised to carefully consider the above-mentioned risks in relation to the opportunities provided by the cloud. Of course, hacking is always a possibility with cloud providers, but this is also the case with an in-house data center. Cloud providers may be a more attractive target due to their size, but their large-scale structure enables them to resource more expertise to resist such attacks. Cloud providers are currently making substantial investments and are issuing serious guarantees in order to comply with local rules and regulations.

Standardization versus bespoke solutions

ERP supports the core processes of an organization. Standard ERP implementations often start from the idea of adopting the standard functionality of the chosen ERP system. The intended objective here is to restrict the costs by not getting bogged down in continual adjustment of the ERP system. However, experience has shown that organizations are often tempted to apply tailor-made routines so that they can realize organization-specific process features in the ERP system.

As mentioned earlier, the multi-tenancy aspect plays an important role in cloud solutions. Cost-saving can be realized by sharing basic functionality with other cloud users. Of course, the cloud solution will always have configuration variables, such as the ledger layout and workflows, which an integration partner can make organization-specific.

However, tailor-made routines are in conflict with the primary concept of multi-tenancy. Their software can no longer be offered in an efficient and scalable way, and this means a retreat to private cloud solutions, from which the organization may draw less benefit.

If cloud-based ERP clients are truly prepared to apply multi-tenancy (sharing), they will have to comply with a standard configuration of processes. As a result, customized configuration at a local level will be kept to a minimum. This standardization offers advantages and disadvantages. The advantages lie in the reduction of the complexity of the processes and structure. At the same time, the processes are more transparent, and better documentation is generated. The implementation of these processes is also made easier through the use of standard processes. However, for an organization to implement and comply with standard processes demands a willingness to

Tailor-made routines are in conflict with the primary concept of multi-tenancy

Suppliers of cloud ERP store data in a specific way so vendor lock-in should not be underestimated

adapt, as well as organizational flexibility. It is advisable for the organization to identify the necessary adaptations as early as possible and to integrate them into the implementation procedure.

Connectivity and integration

ERP cloud solutions generally make use of an underlying platform. ERP providers also offer this platform so that third parties may develop supplementary functionality. Several providers (such as Tblox for example) offer in various functionalities that have been developed internally or externally via an app store. The benefits for third parties (simple access to several clients) and for the ERP provider (broader functionality) are translated into an enormous potential for the ERP client.

In addition, there is potential for even more far-reaching integration: chain integration. An ERP using organization can use a purchasing module, for example. If their supplier uses the same ERP system, they are actually making use of the same system: a purchasing order for party A is simultaneously a sales order for party B. This integration offers various benefits: the synchronization is more securely guaranteed, organizations can share master data, and interaction between the parties occurs in real-time without extra connections.

In the act of considering cloud-based ERP solutions, an organization should look not only at the ERP solution itself, but also at the so-called "ecosystem". The organization must carefully weigh up the advantages for chain parties that also make use of the same ERP solution. There must be clarity about the interests of chain partners as well as the intended efficiency benefits.

Availability and performance

Cloud solutions are available when there is access to the internet. This provides possibilities to deploy mobile devices such as smartphones and tablets, for example. It does mean, however, that the organization is dependent on the internet connection. Third parties that manage internet access must be included in the chain of dependencies, and agreements concerning the availability and recovery times must be revised to guarantee this chain.

Flexibility

Because production environments have been set up in the cloud, test and training environments can also be realized for a short time and on request. In doing so, it is not necessary to buy extra server space, as this is obtained in subscription form, just as the production environment is.

Due to the limited effort required at implementation, the subscription model and the availability of trial versions for cloud services, it becomes easier for clients to switch to other cloud providers.

Nevertheless, vendor lock-in is a risk that should not be underestimated. Suppliers of cloud ERP store data in a specific way, so that it is not always certain that this data can be easily migrated to other providers at a later date. For the cloud client, it is important to know how information management and the ownership of data are configured. Clients are advised to cover the related risks in contracts with the suppliers, with explicit attention being paid to potential migration.

Providers and the current state of affairs

Various parties have seized upon the cloud as a distribution model for their software. Due to the fact that these parties have developed software on the basis of multi-tenancy and virtualization, they have been able to offer ERP software significantly cheaper. As a result, they have been able to gain an initial advantage over their larger competitors such as SAP, Oracle and Microsoft.

Notably, such providers mainly focus upon (sub)processes rather than on the complete operational management to which ERP aspires. In this context, one can think of TBlox, which is primarily directed toward supporting purchasing functionality, or of Raet, which supports the HRM domain. For corporate financial operational management, these processes are relatively easy to distinguish and consequently entail relatively little complexity and dependency. Furthermore, there are also suppliers that serve a specific branch, such as ServiceNow for instance, which provides an ERP cloud platform for the ERP of IT service providers that support processes ranging from project management to IT operation.

Traditional ERP suppliers believe it to be essential to offer several of their products in the cloud. This enrichment of the product assortment gives customers the opportunity to make choices and create combinations. In addition, the cloud makes ERP products more accessible to small and medium-sized enterprises. ERP suppliers are defining new propositions such as "two-tier ERP," where a cloud

variant is offered for use in the smaller and less complex subsidiaries of larger companies, while complex and expensive ERP solutions exist at the corporate level.

Parties such as SAP, Oracle and Microsoft, each with its own traditional sales model for ERP, are now offering a broad palette of cloud solutions. Their solutions are outlined below.

SAP

With the support of cloud services, SAP is now capitalizing on improved access to products and applications. SAP's cloud-based ERP solution, SAP Business ByDesign (2010), supports all business processes on the basis of a single solution that is particularly suitable for small and medium-sized businesses and smaller entities of multinationals (subsidiaries). However, SAP has no current plans to make its core R3 system available in the cloud. With the takeover of Ariba and the Ariba Network, SAP is trying, however, to place a cloud platform in the market by means of which various ERP systems can communicate with one another.

Oracle

With Fusion Applications, Oracle offers a new range of on-demand and open-standard ERP products. And with its cloud services, Oracle is focusing on future social, interactive and mobile business methodologies. One difference with SAP is that Oracle provides virtualization and hardware, in addition to SaaS, and thus has a full range of cloud products on offer.

Microsoft Dynamics

Microsoft provides (ERP) products via a partner network. As a basis for this network Microsoft has set up Azure, which has a PaaS function, enabling the development of SaaS templates for Dynamics.

In general, among various suppliers we can recognize a focus on less complex environments, such as smaller organizational units (subsidiaries / business units) and small and medium-sized enterprises.

Because cloud services are geared to standardized configuration, this will bring challenges to the relationship between producers and sales partners in the future. Releasing the source code for the purpose of developing "branch-specific" solutions, as opposed to standardization, may result in conflict. At the same time, it should be noted that the number of complete ERP solutions in any public cloud is limited. Often, the cloud solutions on offer started with a focus on a subprocess, with the functionality later being extended to meet customer demands. Because these providers have a sizable customer portfolio, it is likely that several cloud-based ERP systems offering functionality across the entire front will arise in the near future, forming a genuine alternative to the current members of the establishment: SAP, Oracle and Microsoft.

Thus, the substantiation of cloud-based ERP by suppliers is still in full swing. New parties appear on the market with great regularity, enlarging the available assortment, while existing parties are extending their range of products. Organizations are being challenged to reconsider their short and long-term strategy and to determine the extent to which cloud-based services can add value to their ERP set-up.

Conclusion

In developing an ERP strategy and in selecting a particular ERP system, organizations would be well advised to consider the various scenarios for ERP in relation to the cloud and to integrate them into the selection process.

If the ERP is oriented toward restricting costs and outsourcing IT, making use of the cloud infrastructure layer (IaaS) in combination with existing ERP software and licenses can provide sufficient functionality. However, if the organization wishes to go a step further, it should not regard a trip to the skies as a technical exercise but should embrace the principles of the cloud and adopt standardized processes. Companies should ask themselves about the extent to which they are capable of sharing processes and the corresponding IT structure without compromising their key business requirements.

The functionality and availability of the cloud-based ERP on offer is still rather limited and still under development. Besides functional restrictions, meeting customized local requirements is also an issue: for example, if the solution is to be used in several countries where financial regulations differ, some aspects may need to be tailor-made. Due to the youthful character of cloud applications, these products

enjoy insufficient market confidence as a result of possible continuity and compliance risks.

Suppliers are rightly directing their efforts toward the small and medium-sized entrepreneurial sector. For this sector, the cost benefits are most significant in relation to the scalability that it can realize itself. In addition, the need for tailor-made products can be limited. When selecting a supplier, it is important to evaluate the philosophy of the organization with regard to interfacing, the ecosystem and chain integration. Apart from the functionality, this also allows a view into the potential of the supplier and the ERP package on offer.

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