

# CLOUD COMPUTING – IT’S BIGGER THAN YOU THINK

*how cloud-based accounting, ERP and CRM applications will change your business*

*By John S. Howell, Jr.*

**E**very ten to fifteen years or so it seems we have a technology revolution in computing and business IT. A new generation of technology becomes so superior in delivering lower cost and increased productivity that before you know it the old way looks positively archaic.

Unlike old fashioned revolutions with muskets and cannons, technology revolutions are often hard to differentiate from incremental change until after the fact. One way to know if you are in a revolution is the “you can’t get there from here” factor. When the PC first appeared it wasn’t just a tiny version of a mainframe computer – it was based on a whole new architecture built with completely new types of processors, memory and storage. Because of this new architecture, everything else had to change – software, peripherals, even distribution and support.

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A real technology revolution turns economics upside down – things that were once scarce and expensive can suddenly be abundant and almost free. Processing power and memory were once wildly expensive, now they are nearly free in comparison. Bandwidth was so slow and expensive that companies charged by the word for a telex. We now view bandwidth as abundant – something you get as a free perk for visiting a coffee shop, or provided with your hotel room. This upside-

down-ing of economics changes the old rules to the point that they work against you. Business books are full of stories about defunct companies who intellectually understood everything about the revolutionary technology of their day, yet were helpless to change because the old rules were embedded so deeply in their cultural DNA.

We are now in the midst of a new technology revolution called Cloud Computing<sup>1</sup>. It’s bigger than you think. Cloud Computing is not just about using applications over the Internet, or SaaS. Cloud Computing *is* the next generation of Computing. It’s a revolution because it affects everything. Even if you are just interested in computing on-premises, Cloud Computing technologies will change everything about how you do it and give you more for less.

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<sup>1</sup> The US National Institute of Standards and Technology (NIST) says: “Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.”

## Cloud Computing changes the rules for Accounting, CRM and ERP applications.

This paper discusses how Cloud Computing turns the orderly world of database-oriented business applications upside-down on their virtual ledgers. The disruption is caused by the fact that existing Accounting, ERP and CRM applications cannot simply be 'cloud enabled'. Cloud Computing technologies go right down to the core of applications so that the only viable option is to start over. To do otherwise would be like trying to make a car out of a horse carriage.

Cloud Computing enables cloud-based Accounting, ERP and CRM systems. Organizations with sophisticated requirements are now deploying these systems in increasing numbers<sup>2</sup>. Why? Productivity can be

*“Cloud Computing is not just about using applications over the Internet, or SaaS”*

dramatically increased. Applications can be conveniently and securely accessed from anywhere, on any device. Cost can be lowered. Cloud-based systems can be deployed anywhere and supported via a variety of service models ranging from self-service to full-service. They can be deployed in virtualized, multi-tenant environments residing in private or public datacenters. Web standards enable more powerful ERP applications and rapid, cost-effective, seamless integrations between applications. The list goes on, but the reasons overwhelmingly point to a revolution in business processing made possible by Cloud Computing. It is a revolution enabled by the convergence of multiple technologies and their acceptance as standards, and most critically for the business user – it is a revolution delivering higher productivity – at lower cost.

## WHAT MAKES CLOUD-BASED BUSINESS APPLICATIONS BETTER?

So what is it exactly about a cloud-based business application that makes it so powerful? Specifically what advantages does a cloud-based ERP, CRM or Accounting application have over other types? Let's begin by looking at some of the underlying factors that make Cloud Computing possible, and how these factors in turn contribute to the power of cloud-based applications.

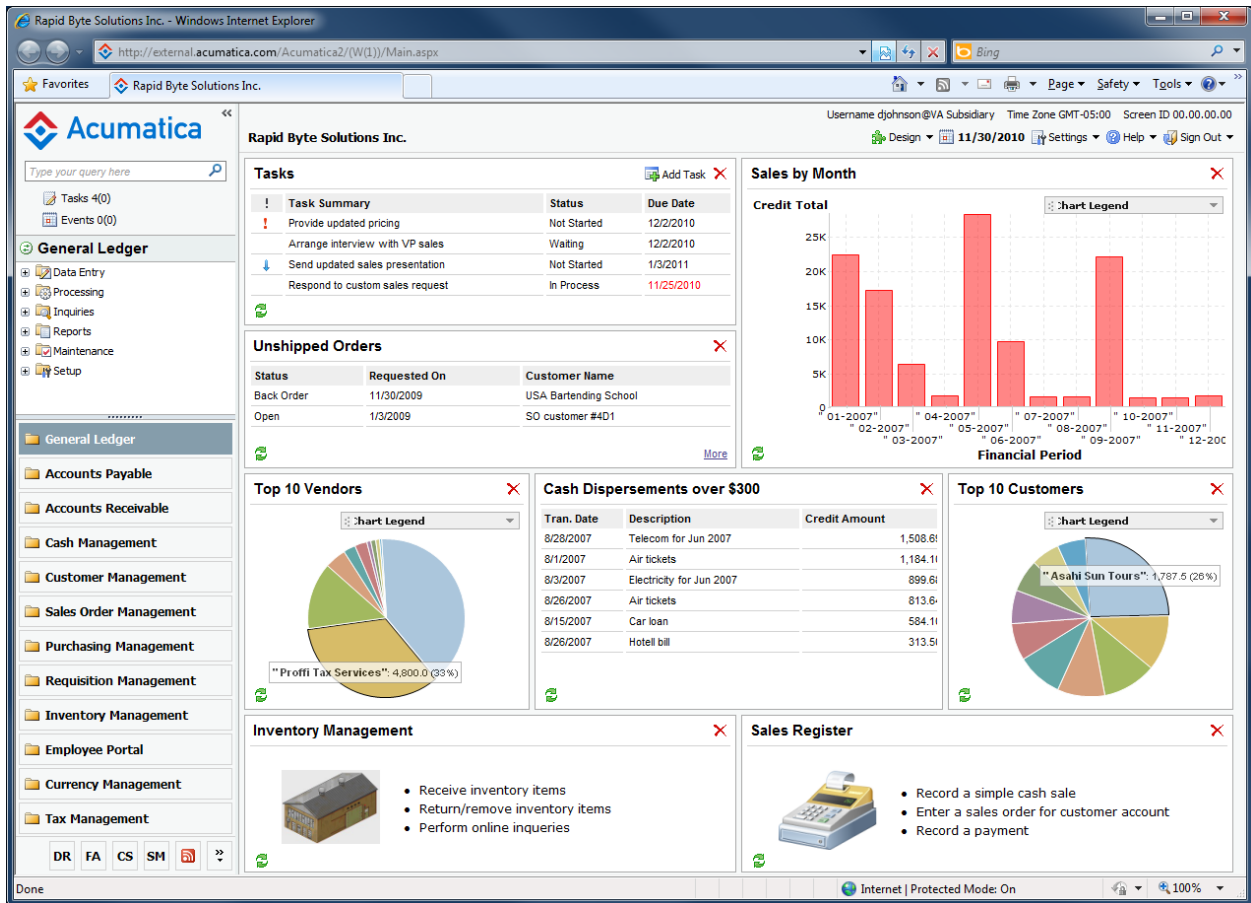
### 1. Web standards

Work anywhere – on any device - HTML, HTTP, the Document Object Model, JavaScript and other web standards enable the delivery of a complex, interactive, responsive, graphical user interface via a standard web browser. This means business applications built to web standards are usable from anywhere and automatically available on a wide variety of devices – from PC's to Mac's, and from laptops to iPads to smart phones and other lightweight<sup>3</sup> graphical clients. Enabling individuals to work from wherever they happen to be increases productivity and reduces the latency in business processes.

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<sup>2</sup> For Q1 2010 Salesforce, Inc. (cloud-based CRM) reported 4,800 net new customers. NetSuite, (cloud-based ERP) reported 280 new customers for Q2 2010. In Intuit's Aug 2010 analyst call, CEO Bill Smith cited 200,000 new QuickBooks Online users per year.

<sup>3</sup> Lightweight in the sense of not requiring a lot of computing resources like CPU or RAM.



**Figure 1** – Cloud-based ERP menus and dashboard in the Internet Explorer web browser (Source: Acumatica)

Purchase approvals, for example, can be made from home, from hotel rooms, or at airports while traveling. Inventory, pricing, or project status can be checked from customer offices. Most mid-size and larger businesses have more than one location so processing can be centralized in one location and available to all locations with excellent performance and low cost. Web standards enable business applications to securely be where your users are.

Web standards also make it easy to embed one application within another, even if they reside on different servers. A YouTube video describing a product can be incorporated into an ERP inventory page by the person responsible for maintaining the product description – no programmer needed. Free cloud-based services like Google Translate can automatically and ‘on-the-fly’ translate product descriptions, forms, reports, and application text into more than 50 user languages, far more languages than would be feasible to

*“Enabling individuals to work from wherever they happen to be increases productivity and reduces the latency in business processes.”*

maintain manually<sup>4</sup>. Tabbed web-browsers make it easy to have multiple application screens open at once so interruptions and ad-hoc requests can be accommodated without losing one's place. URL's to specific documents within the ERP or CRM system can be emailed, providing recipients with quick access to specific information.

With cloud-based applications, nothing needs to be installed on a user's computer or device. This simplifies operation for the user, and reduces the overall cost of maintenance. Cloud-based applications make it feasible to include everyone in your organization at low cost.

*"With cloud-based applications, nothing needs to be installed on a user's computer..."*

Of crucial importance to ERP, web standards enable powerful servers. Business processing can be centralized, controlled and backed up in a secure data center, and only the bits displayed to the user need be sent via a web server over the network. Likewise, XML and web-service standards enable low cost, secure integrations between applications.

The web standards developed by the W3C, IETF, ISO and others describe how the web works, and provide the framework for building modern business applications.

Statelessness - Cloud-based applications are 'stateless' and loosely coupled. It is largely the statelessness of cloud-based ERP applications that makes them usable over the Internet and makes them more scalable, more secure, and more reliable than their predecessors. Stateless applications are designed to remain stable even if a user disappears mid-session. But supporting statelessness requires a big shift in application design, and thinking - and is perhaps the key reason why so many cloud-based ERP and CRM systems today come from relatively new companies<sup>5</sup>. It turns out that "cloud-based" just can't be added as a feature to an older product - you have to start over.

There is simply no acceptable way to enhance an older non-cloud-based ERP application so that it is all of a sudden stateless. Unlike 'stateful' client-server ERP systems, there are no resources reserved on a server for the user after a request for information is fulfilled. This means each server can support more concurrent users. In a stateless ERP system each request to the server, no matter how small, contains authentication information regardless if the server is on a public or private network. Stateless systems can also "scale out"<sup>6</sup> horizontally to achieve better performance by adding more servers. In practice, for a larger system, this might mean the first 10 lines of a customer order might be processed on server A, and the next 10 by server B -- while the user experience is that of interacting with one system.

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<sup>4</sup> The Google translation utility is enabled by an extension in the user's web browser so there is nothing that need be done within the ERP application itself. Browsers like Google Chrome even automatically sense if a web page is not in the users native language and offer to translate pages automatically.

<sup>5</sup> Dates founded: Acumatica 2007; SugarCRM 2004; Salesforce 1999; Netsuite 1998.

<sup>6</sup> Of course stateless systems can also "scale up" by running applications on more powerful machines.

## 2. Reduced Computing Costs

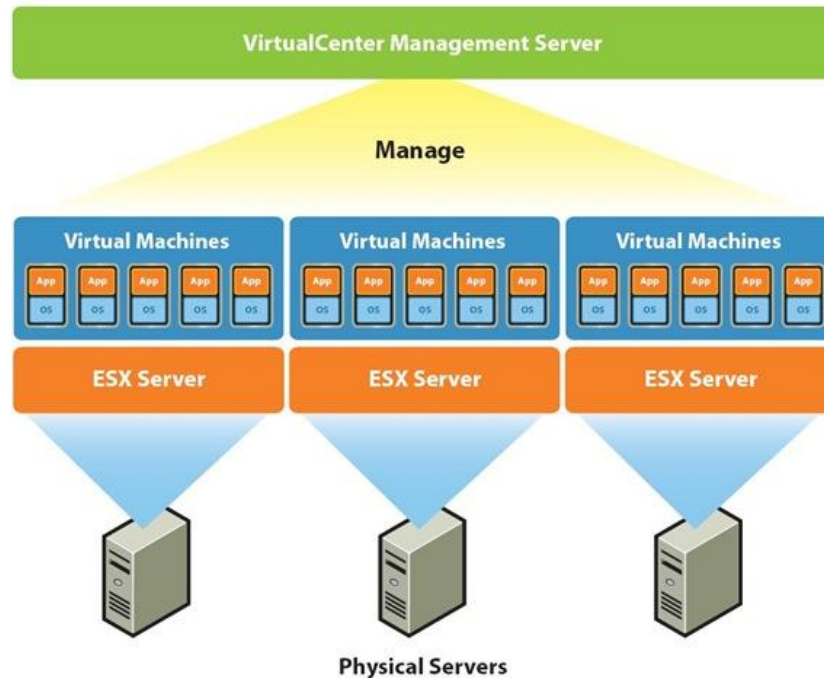
x86 standards - Standardization on the Intel x86 instruction set provides the foundation for scalable, inexpensive data centers. Almost all web server processing, and therefore almost all Cloud Computing, is done on x86 standards - from the smallest web site to Facebook with its 500 million active users. Google has somewhere around one million servers supporting 1 billion users weekly – all based on x86 processors produced mainly by Intel and AMD. Powerful processors like the Sun UltraSPARK, and IBM’s PowerPC are good, but they are not the standard – and it is the x86 standard that is driving an entire ecosystem of supporting products, and the cost of processing cloud-based ERP to almost nothing.

Virtualization of the entire datacenter converts expensive IT expertise into inexpensive software. Virtualization of Intel x86 hardware today enables 12 to 24 or more<sup>7</sup> virtual machines per physical host server and when combined with virtualized networking and storage enables the management of a large number of computing resources from a single console. The “Datacenter as a Computer”<sup>8</sup> is here. Console products like VMware’s vCenter Server and Microsoft’s System Center enable centralized management of groups of private virtual machines while consoles from Amazon AWS and Rackspace Cloud enable web browser management of on-demand, multi-tenant virtual machine pools offered to anyone with a credit card. As Moore’s Law enables 2x the processing power for the same cost every two years, prices will just continue to drop. Virtualization enables the huge public datacenters we read about, and their elastic ability to scale almost infinitely, but it also enables a new low cost paradigm for small in-house datacenters. Cloud-based ERP runs on standard virtualized infrastructure no matter where it is located or who is running it, or how big or small the facility.

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<sup>7</sup> The ratio of virtual machines to host depends on workloads, number of processors, amount of memory, etc. In an October 7, 2010 post to [virtualizationpractice.com](http://virtualizationpractice.com) Steven Beaver, co-author of [VMware ESX Essentials](#) says, “...In this specific case the hosts were going to be HP DL580s running twenty four processors and 256GB RAM each. Those boxes are pretty beefy and should be able to run at least sixty to one hundred virtual machines each without any issues. Your mileage may vary but let’s just say that you can get one hundred virtual machines per host.”

<sup>8</sup> Halter, Eric M. and Chris Wolf. [Virtualization from Desktops to the Enterprise](#). New York: Springer-Verlag, 2005.



**Figure 2** - Console products let you manage large numbers of virtual resources from a central point. (Source: VMware)

Virtualization de-couples applications from hardware so live ERP systems can be migrated across physical hosts on the same LAN with no perceived down time<sup>9</sup>. Standard virtual machine image file formats like Amazon AMI, and VMware’s Virtual Machine Disk VMDK<sup>10</sup> enable complete ERP systems including applications, SQL databases and other middleware to be packaged into a single file and moved anywhere over the network without regard to the underlying hardware. These files are what enable you to move a complete cloud-based ERP application from one infrastructure vendor to another in minutes, or even to your own virtualized private machines<sup>11</sup>.

Cloud Computing comes in all sizes too. Intel labs is demonstrating its ‘Single-chip Cloud Computer<sup>12</sup>’ containing forty-eight x86 compatible cores and a nano-scale network running at 256 gigabits per second, connecting them together – all on one chip! This chip provides a powerful reminder that Cloud Computing is not just about huge data centers. On-premises IT is not necessarily replaced by this revolution – it becomes less expensive, simplified, and empowered more than ever.

<sup>9</sup> It sounds impossible, but it actually is quite straightforward – the live systems memory and files are copied to the new machine while the old system continues serving users. Once the copying is complete, an astute user might notice a pause of about 1/3<sup>rd</sup> second while the new system synchronizes and becomes the new master.

<sup>10</sup> Other formats include Microsoft/Citrix/Xen Virtual Hard Disk VHD, and OVF Open Virtualization Format.

<sup>11</sup> While machine image files are not always directly interchangeable between virtualization platforms, there are third party products like Eucalyptus and CloudSwitch that enable this.

<sup>12</sup> <http://blogs.intel.com/research/2010/09/marc-scc.php#more>

### 3. The Network Effect

*Involving everyone* – When a network effect<sup>13</sup> is present, the value of a product or service increases as more people use it. Robert Metcalfe, one of the co-inventors of Ethernet networks, explains<sup>14</sup> that while the cost of adding new endpoints to a network is directly proportional to the number installed, the value of the entire network is proportional to the *square of the number of endpoints*.

A Cloud-based application organized around an integrated database, and accessible from anywhere, encourages a network effect because the cost of adding a user is negligible. At the same time, the more people you have contributing and connected to your ERP, CRM or accounting system, the more timely, accurate and complete the picture of your operations, and the more valuable your system is to each user and to the organization overall. A Cloud-based business application lets you involve everyone including sales, operations, marketing, finance – even vendors, customers, external auditors and consultants.

*Connecting applications* – The network effect operates between applications too. Because of web standards, Cloud-based ERP applications can interact with each other inexpensively, and with other specialized applications over the network. Cloud-based applications instantly reach each other using standards-based Universal Resource Identifiers (URIs), and then use an XML defined information interface to exchange data and delegate processing to specialist applications. Each new application connected to the network potentially adds value to all the others.

There are Cloud-based applications that can be used to inexpensively augment ERP, CRM and accounting applications for sales tax calculation, payroll processing, bank transfers, credit card processing, exchange rate calculations, credit checking, and web-shopping cart management to name a few.

Taken together and combined over private networks or the Internet, the standards and technologies that enable Cloud Computing, and cloud-based applications, change the status-quo in business computing and create a bonanza of opportunities for businesses to reduce costs and increase productivity.

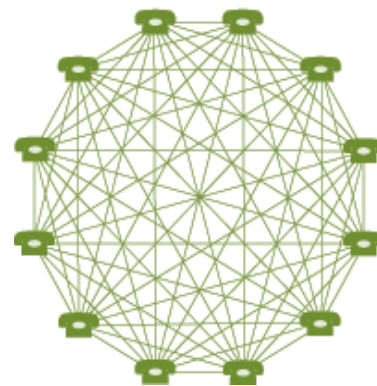


Figure 3 – The telephone is an example of the “network effect”, where the value of a product or service increases as more people use it.

<sup>13</sup> “Network Effect” [http://en.wikipedia.org/wiki/Network\\_effect](http://en.wikipedia.org/wiki/Network_effect)

<sup>14</sup> “Metcalfe’s Law” [http://en.wikipedia.org/wiki/Metcalfe%27s\\_law](http://en.wikipedia.org/wiki/Metcalfe%27s_law)

## ***ISSUES TO CONSIDER***

Next let's take a critical look at some of the issues faced by organizations contemplating Cloud-based business applications, discuss misconceptions, provide some recommendations, and offer a few caveats.

### **Common Misconceptions**

- Misconception #1 – “Cloud-based applications only run over the Internet.”

Clarification: Cloud-based applications run over the Internet by default, but the same applications also run on completely private networks. Even if your company has no intention of letting “Internet users” access your Accounting or ERP system, the fundamental advantages of cloud-based applications still provide a game changing edge vs. older systems.

- Misconception #2 – “Cloud-based is the same as SaaS.”

Clarification: Cloud-based applications enable Software as a Service (SaaS) – not the other way around. SaaS is a powerful business model for delivering cloud-based applications and corresponding services, but it is not the only business model, or even the most predominant one. Cloud-based applications are available under almost every conceivable deployment, licensing and support model – from traditional license to open source and from on-premises to hosted deployment.

- Misconception #3 – “Cloud-based applications are not customizable.”

Clarification: There is no technical barrier to adding the most sophisticated features for customizability to Cloud-based applications. Differences in customizability between products are a result of developer know-how, skill, choices and focus. If a product is not customizable enough, look to the developer, it's not the technology holding it back.

### **Security**

Achieving the highest levels of security in a cloud-based ERP application, at reasonable cost, is now possible using the same standards-based web technologies used by bank web sites. At a minimum these include:

Encryption. Web standards like SSL and TLS encapsulate application-specific protocols like HTTP to form encrypted HTTPS so no one can hijack a web session or read the data – even if it is passing through an open Wi-Fi network. HTTPS introduces negligible computing overhead so there is no excuse to not use it. Even Google's free Gmail system supports HTTPS as its default behavior.

Server side processing. Most well designed ERP applications for the Cloud do not install files or components on user machines. Business logic is executed only in the server. Not only does this reduce expense by not requiring each machine to be updated with every version

or patch, it also insures the system will not accept manipulated data from a malicious program in the browser.

Other techniques to improve security using cloud computing include:

Cloud backup. Lost and misplaced backup tapes can potentially be the source of large security breaches. Even if you run your ERP application on-premises it may be safer and less expensive to automatically keep backups in the cloud. Vendors like Zmanda specialize in backing up live on-premises SQL databases and virtual machine images to large public cloud infrastructure providers like Amazon and Azure.

Security tokens. Borrowed or stolen passwords can circumvent the most sophisticated technologies. Augmenting passwords with key fobs that generate time limited passwords provides physical access control from anywhere at very reasonable cost. Secondary, one-time passwords can also be sent to a cell phone via SMS. Products include SecurID from RSA, and many others.

### **SaaS or Self-Deployment?**

Cloud-based applications can be deployed in a greater variety of ways than their predecessors. The benefit is you can optimize features vs. cost more precisely, paying only for what you need. It also means that as your business or organization changes, your applications will have a better chance of keeping up. When considering deployment method, the first decision, assuming your application vendor offers the option, is self-deploy or SaaS? It may be as simple as deciding which costs less, but for most businesses it will be more complex than that. Selecting the right deployment method for your company is not difficult but you may want to enlist the help of an independent consultant as new options are constantly available.

*“Self-deployment has the advantage of enabling high-speed integration with your other applications.”*

1. **Self-deployment** – A self-deployed cloud-based ERP system typically requires an application server, a database server (like MS SQL, or MySQL), and a web server (like IIS or Apache). Depending on transaction volume, all of these servers can be on one machine, or they can be on separate machines – virtual or physical.

Self-deployment has the advantage of enabling high-speed integration with your other applications. All of them can be on the same LAN communicating between themselves at gigabit speeds. The LAN itself however can be on-premises or in an externally hosted location - you don't have to have everything on-premises to get the benefits of high speed integration, you just have to be able to control which applications can be added on the LAN.

Self-deployment may also be the only option as a result of country laws regarding data storage locations, corporate security policies, or lack of Internet connectivity.

Self-deployment provides organizations with control over their metadata. Metadata is “data about data.” The number of purchase order transactions processed monthly, or changes in the number of invoices, orders, or sales lead transactions from the previous month are all examples of metadata. Metadata can be visible even if the contents of the records are encrypted. Some cloud service vendors reserve the right to aggregate metadata for resale so long as the data is decoupled from the identity of the source organization. It would be valuable for example for a hedge fund, or competitor, to know the change in order transactions for a specific industry before the information was public. Disclosure of metadata anonymously may be acceptable to many organizations, but probably not to all. Users who wish to keep metadata confidential can deploy in their own datacenter or even in hosted or public infrastructure where the provider has no knowledge of the type of application being run.

Self-deployment can be done in several ways, each having its own set of plusses and minuses:

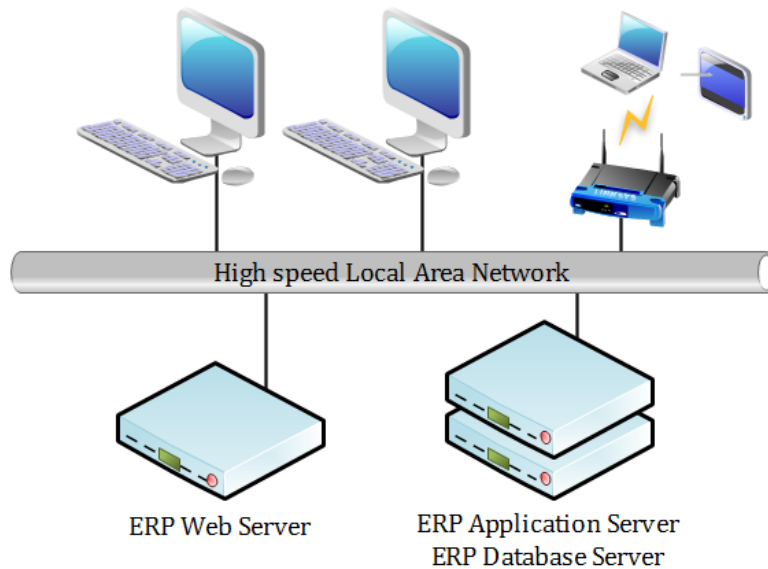
- a. **On-premises** - For many organizations with even minimal IT staff and existing infrastructure it is often just simpler to do the initial deployment and conversion from an old ERP or Accounting system on-premises and then begin with LAN only users on the cloud-based system. If most of the users are on the same local area network performance will be better and more controllable than if over the Internet.

On average, businesses use 20% or less of the capacity of their servers<sup>15</sup>, so cloud-based ERP systems can often be quickly installed on existing standard servers at virtually no incremental cost. Servers can be kept behind the firewall permanently, or until proper security and operating procedures are in place for wider access.

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<sup>15</sup> Halter, Eric M. and Chris Wolf. Virtualization from Desktops to the Enterprise. New York: Springer-Verlag, 2005.

## On-Premises Deployment



*Figure 4 - On-premises deployment of cloud-based ERP systems can be completely isolated from the Internet if desired. This configuration also enables deployment where Internet access is not available and enables inexpensive high speed integration with other applications on the same network.*

Over time, on-premises hardware can be used to build a private cloud where multiple servers are virtualized on one or more physical servers, and where users and/or departments can self-provision, maintain, and de-provision their own virtual computing resources without involving IT staff. Microsoft, for example, enables private clouds with Windows Server Hyper-V and the System Center management console products.

The drawbacks to on-premises hosting of a cloud-based application are similar to the drawbacks of hosting a corporate web site on internal servers. Externally hosted servers located in a professionally managed datacenter usually will have access to more total bandwidth and more reliable bandwidth (due to multiple carrier connections), better UPS power backup, better physical security, and 24 x 7 x 365 monitoring and support. Remote users in different time zones also put more pressure on extending internal support hours.

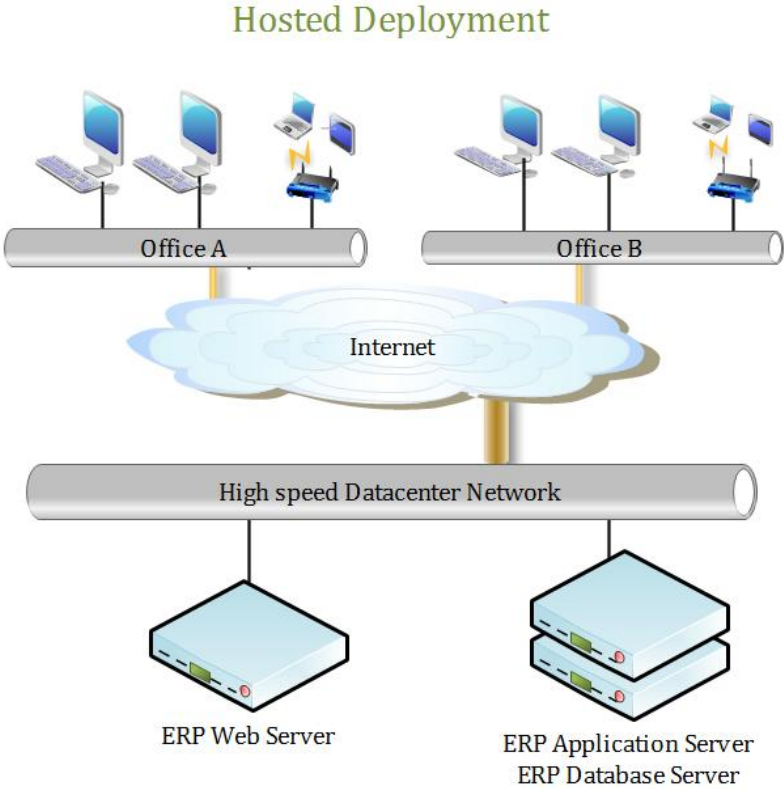
- b. **Hosting** – One of the hallmarks of cloud-based ERP, Accounting and CRM applications is that they can be externally hosted, installed, operated and maintained just as easily as if they were hosted in a machine down the hall. The hosting industry, which started about the same time as

*“One of the hallmarks of cloud-based ERP, Accounting and CRM applications is that they can be externally hosted”*

the web (circa 1995), now has billions of dollars in annual sales and is entrusted with millions of web sites of all types.

External hosting of non-cloud-based ERP and CRM systems was attempted by organizations called Application Service Providers (ASP) circa 1999-2001. The ASP model, which uses terminal emulation in lieu of Web Standards, periodically re-surfaces under different names by hopeful marketing departments, but the high cost, poor scalability, and low performance limit wide adoption. Since we know hosting itself works very well, this helps validate the point that the ERP software itself needs to be designed for the web and cloud computing – once again, we discover there is no shortcut.

Hosting is similar to on-premises deployment in that the responsibility for the overall operation of the application rests with your organization. It's different from on-premises in that your applications run in a professionally managed data center.



**Figure 5** - Hosting enables you to locate ERP and CRM servers in a professionally managed datacenter with abundant Internet connectivity. Even if the Internet connection to one office goes down, the ERP system remains accessible to other Internet users.

Internet connectivity is usually faster and more reliable since hosting companies typically have multiple physical connections with different carriers, and their aggregate bandwidth provides capacity as it is required. Other benefits include 24 x

7 x 365 support, UPS power backup that can run for days using diesel generators, very high physical security, advanced fire suppression, and free very high speed gigabit communication among your local servers. Hosting companies usually have the fiber optic cables provided by their Internet carriers enter the building at different points to reduce the chance of all being accidentally severed at once.

Another benefit to externally hosting ERP and Accounting applications is the ability to better protect the databases themselves. Backing up and archiving data in a data center has the advantage of automatically being 'off-site.' Using fast fiber optic connections to the Internet, backups can be shuttled between hosting centers for redundancy much faster than they could be uploaded from your business.

In addition to traditional Dedicated Hosting where you rent specific servers configured to your specifications, there are at least two other sub-categories of hosting to keep in mind for ERP and CRM applications:

- i. **IaaS** - The hosting industry is transforming from renting physical servers to providing on-demand Infrastructure as a Service (IaaS), where resources like virtualized CPU power, memory, disk space and bandwidth can be instantly rented with a credit card and turned up or down as needed by the day or minute. This means that you can get the 'up and running in minutes' benefit heretofore only available from SaaS providers, from IaaS providers as well.

*"...instantly increase the number of servers online during seasonal peaks, or reduce to the absolute minimum during low periods."*

IaaS makes it cost effective and easy to do end-of-month processing, or analytics processing, on temporary servers so operational performance is not affected. It makes it easy to instantly increase the number of servers online during seasonal peaks or reduce to the absolute minimum during low periods. IaaS does not eliminate the possibility of a hardware problem, but saved machine images are portable and can be used to launch new machine instances in minutes using a control panel. With IaaS, hardware problems are not your problem as you are paying for a running virtual resource.

Amazon Web Services (AWS) is currently the largest IaaS provider, with data centers in Virginia, California, Ireland and Singapore. Cloud-based applications can be quickly deployed using a web browser on AWS via one of the thousands of pre-built Amazon Machine Images (AMI's), which currently include products like SugarCRM and Acumatica. If your product does not have a pre-built AMI, it is easy enough to save any server image complete with application software and middleware as either a public or private AMI. Licenses for the software included in the pre-built images are purchased

independently. If your application requires Microsoft SQL server, for example, you need to obtain a valid license from your supplier, or use one of your existing licenses.

The Amazon EC2 service charges \$0.085<sup>16</sup> per hour for a small<sup>17</sup> Linux server and \$0.12 per hour for a small Windows server (\$62 and \$88 monthly respectively). If you are willing to commit for an entire year, the price for even a large server<sup>18</sup> drops to less than \$100 per month. These prices represent more value per dollar than leasing a computer for the same amount on-premises because they include more than just the hardware – data center hosting, setup, electricity, and maintenance are also included.

IaaS products also offer disk storage by the megabyte. Amazon's S3 service costs \$0.14 per gigabyte per month<sup>19</sup> so each copy of a 10 gigabyte database costs only \$17 per year with guaranteed durability. Also interesting, backups take virtually no staff time to make, you just log in to the management console, tell the system to make a snapshot of your data, and the rest is managed by the service.

In October 2010 Microsoft announced IaaS capabilities on its Azure cloud platform. Through its 'Virtual Machine (VM) role,' Microsoft offers virtual Windows 2008 Servers in the cloud costing \$0.12 per hour for a small<sup>20</sup> virtual Windows Server, \$0.15 per gigabyte per month for disk storage, with additional charges for I/O and bandwidth. Microsoft says users will be able to migrate machine images containing multi-tier applications like ERP and CRM from on-premises servers to the Azure cloud and back.

As if all this was not enough, vendors like CloudSwitch and RightScale provide applications and services that enable you to transparently manage and migrate entire IaaS deployments (consisting of multiple machines, middleware, databases and applications) between your local virtual machines and your IaaS vendor account. CloudSwitch, for example, enables you to move on-premises VMware based systems to your Amazon EC2 account. Both Linux and Windows Server are supported.

Assuming the costs are right, the concerns with IaaS for ERP mainly involve the Service Level Agreements (SLA) commitments being made by IaaS vendor and the relative immaturity of IaaS products in general. Another

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<sup>16</sup> Amazon prices as of November 2010.

<sup>17</sup> Amazon EC2 small images have 1 virtual 32 bit core, 1.7GB memory, 160 GB image storage.

<sup>18</sup> Amazon EC2 large images have 2 virtual 64 bit cores with 7.5 GB memory, 850 GB image storage.

<sup>19</sup> Amazon S3 pricing as of November 2010 is tiered based on total terabytes (TB) stored: \$0.14/GB/month, for first TB; \$0.125/GB/month for next 49 TB. Lowest price tier is \$.055/GB/month for over 5000 TB.

<sup>20</sup> Azure Extra Small Compute instance: CPU 1.0 GHz, Memory 768 MB, Instance Storage 20GB, Low I/O performance. Azure Small Compute Instance: CPU 1.6GHz, Memory 1.75 GB, Instance Storage 225GB, I/O performance moderate.

concern is the availability of timely personal support from the IaaS vendor – usually a requirement for mission critical ERP and Accounting systems. Some IaaS services offer literally no support while others, like RackspaceCloud, focus on it.

- ii. **PaaS** – Taking things one step further than IaaS, Platform as a Service abstracts almost all the resources required to run cloud applications. With PaaS there is also no need to purchase or maintain an operating system, web server or SQL database. PaaS however is usually very specific to a set of development tools and/or to a specific vendor’s hosting platform.

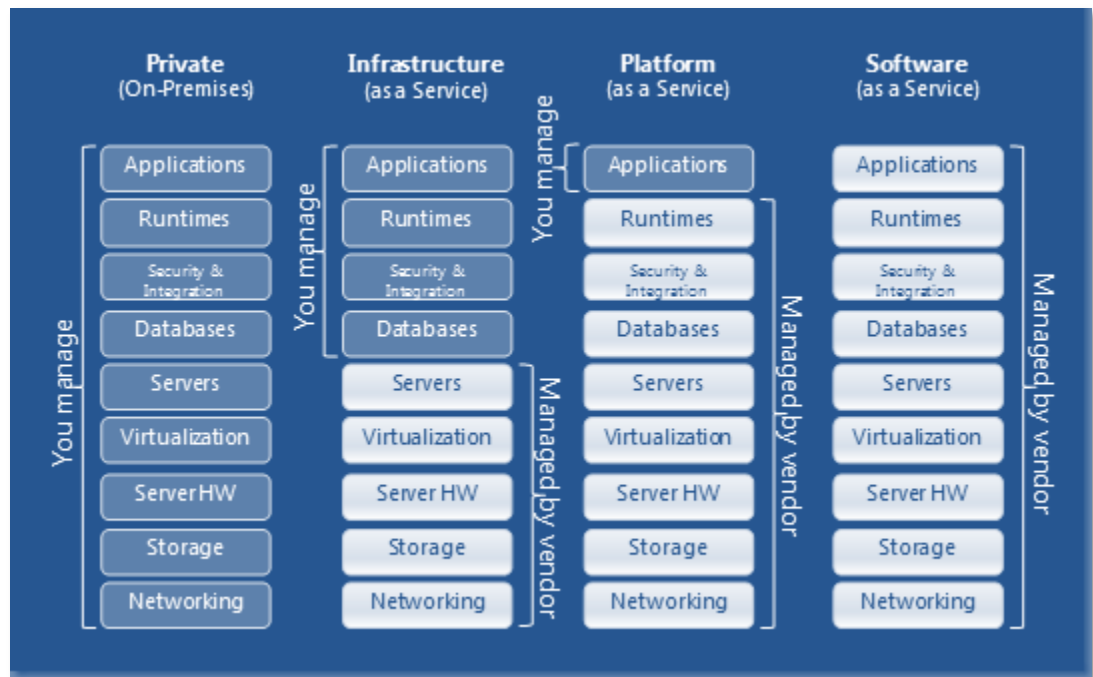


Figure 6 – Management responsibilities under different Cloud Computing Service Models (Source: Microsoft)

Salesforce’s PaaS product is called Force.com. Force.com applications are built using Apex (a proprietary Java-like programming language) and Visualforce (a proprietary syntax for building user interfaces in HTML). Force.com applications are only deployable on Salesforce’s platform. Google’s App Engine is currently restricted to applications written in Python and Java.

Microsoft Azure offers Windows Azure, a PaaS product supporting cloud applications built with .NET tools and technology. An interesting advantage for Microsoft is that in addition to the large number of trained .NET developers, it is relatively easy to build applications that can be deployed either on Windows Azure or on standard on-premises Windows Servers.

With Windows Azure, instead of loading normal runtime files on a server, developers load .NET runtime images specifically for Windows Azure. The benefit is that you only need to maintain the application while the PaaS platform takes care of everything else. Windows Azure costs \$0.12 per hour for a virtual Windows Server, \$0.15 per gigabyte per month for disk storage, with additional charges for I/O and bandwidth.

It should be noted, at least at the moment, that Windows Azure is developer focused. Organizations wishing to deploy ERP systems on Windows Azure will need some in-house .NET expertise, or will want to work with an external consulting team.

SQL Azure is a complete Platform as a Service database. SQL Azure is compatible with the Microsoft SQL database and performs as if it resides on the same LAN as Windows Azure. For all but the largest users, SQL Azure will likely be more powerful, more stable, and more durable than an on-premises version of MS-SQL. SQL Azure automatically replicates all data to provide high availability. SQL Azure also manages load balancing for scalability, and in case of a server failure, provides transparent fail-over. SQL Azure has no up-front license fee and costs \$10 per gigabyte of database size per month<sup>21</sup>.

Amazon RDS is a relational database service based on MySQL. As with SQL Azure, RDS automatically patches the database software, backs up your data and promises more scalability than most businesses would require for ERP, Accounting and CRM. RDS databases are 100% compatible with MySQL databases, providing deployment flexibility. For those wishing even higher data durability and availability Amazon offers a 'Multi-AZ Deployment' option which automatically maintains a standby replica of your database in a different data center. So your production database could be in the Virginia datacenter while your standby replica is in California. Should the main database fail, Amazon RDS automatically switches over to the standby database without administrative intervention. Pricing for RDS is based on the 'Instance Class' size. A Large DB Instance with 7.5 GB memory and two virtual cores costs \$910<sup>22</sup> on an annual commitment or \$0.44 per hour on-demand. Amazon RDS also charges \$0.10 per GB-month for storage and \$0.10 per 1 million requests.

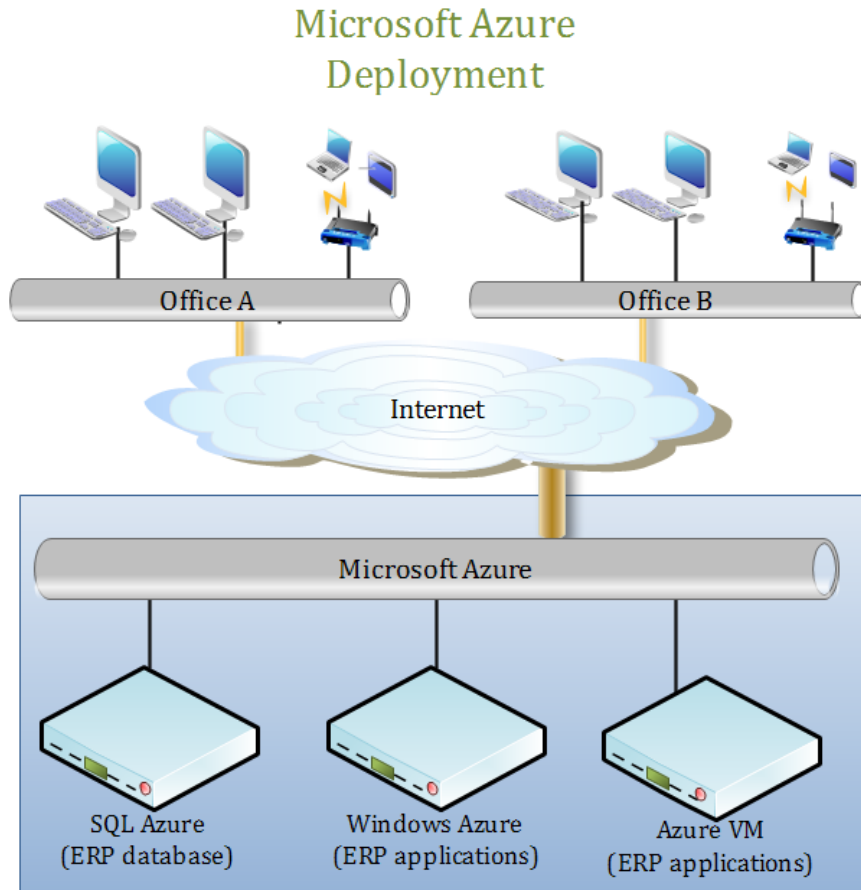
- iii. **Full Service Clouds** – Since PaaS and IaaS each have their place, some vendors offer both, enabling high speed integration across the two. Using a full service cloud you can deploy multi-tier ERP and CRM applications with

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<sup>21</sup> Up to 1 GB relational database = \$9.99/month; Up to 5 GB relational database = \$49.95/month; Up to 10 GB relational database = \$99/month; Additional 10 GB increments beyond 10 GB = \$99.99/month. Data transfers = \$0.10 in per GB / \$0.15 out per GB.

<sup>22</sup> As of November 2010.

some parts on IaaS and others on PaaS. A scenario would be to deploy the ERP application runtime in, say, an Azure VM running Windows Server, and to connect the application to your database running on SQL Azure. This provides a very durable, low cost, MS SQL-compatible database fully managed by Microsoft, while retaining the flexibility to run standard packaged application runtimes for cloud ERP or CRM applications.



**Figure 7** – Microsoft Azure is an example of a full-service cloud. It enables integration of PaaS and IaaS services at very high speed. Databases can be provisioned on SQL Azure (a fully managed PaaS service) and accessed from off the shelf runtimes installed on Azure VM's and/or from .NET applications on Windows Azure.

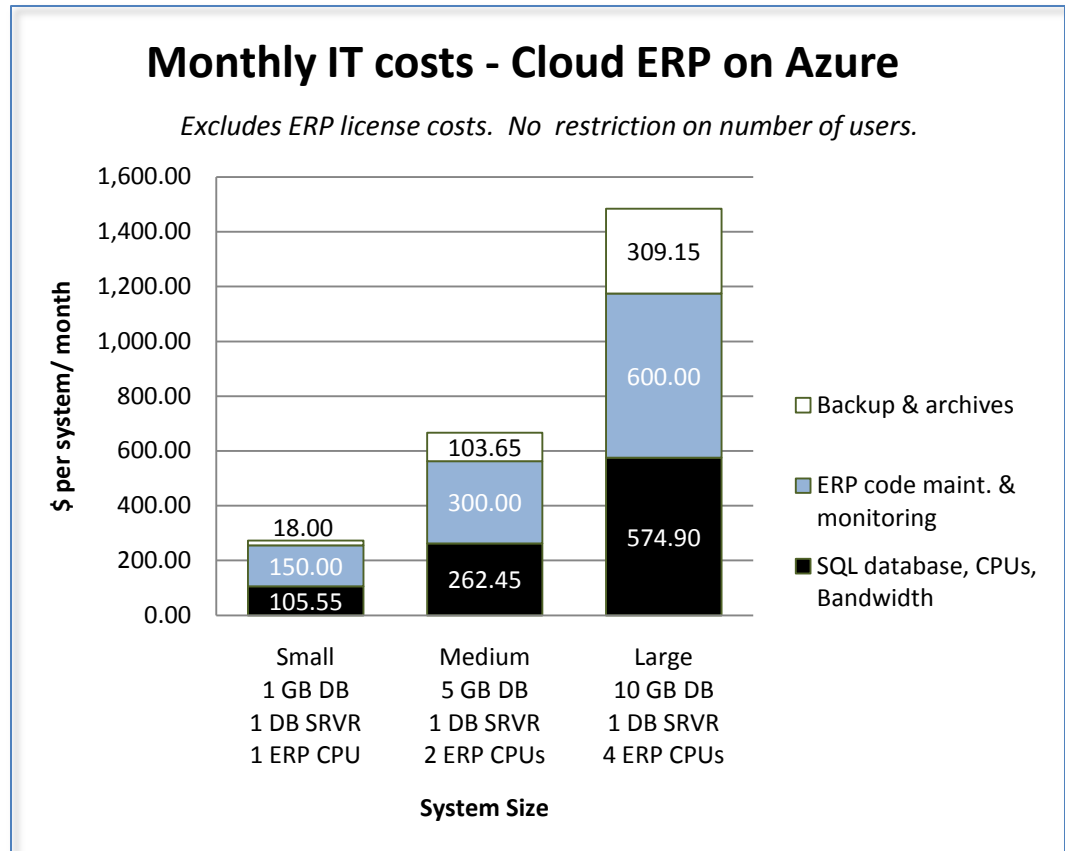
IaaS and PaaS provide many services like instant provisioning, auto-scaling, and database management that previously were only associated with SaaS. External hosting of cloud-based ERP and other database oriented business applications on IaaS and PaaS platforms will no doubt become more commonplace as these platforms prove themselves to be secure, reliable, cost effective alternatives to both on-premises and traditional hosting.

- c. **Running ERP in the Cloud - Cost Example** - The graph that follows shows monthly cost examples for running and maintaining cloud-based ERP and CRM systems using Microsoft Windows Azure and SQL Azure as of November 2010. Costs on Amazon are similar using Amazon EC2 (compute), S3 & EBS (storage) and RDS (database) services. SQL Azure is unique to Azure, making Azure attractive if you require Microsoft SQL compatible services. Likewise, Amazon RDS is unique to Amazon, making Amazon attractive if you require a managed MySQL database service.

Costs in each size scenario are broken down into three areas:

- i. SQL database, Application server CPU's, Bandwidth - The costs for SQL Azure include a running database server capable of supporting one or more databases. SQL Azure is billed by the total database size, ranging from 1 GB to 10 GB in the examples. In addition to the database server, each scenario has Windows Azure servers containing one, two or four CPUs. The CPU's run the ERP application and the web-server. Peak performance capacity can be varied by simply increasing or decreasing the number of CPU's as needed. Bandwidth usage and transaction levels are also estimated in arriving at the total Azure costs.
- ii. ERP code maintenance & monitoring - With this PaaS configuration the customer is responsible for the installation and ongoing patching of the ERP application code (but not the underlying layers such as the operating system, or database). There is also a cost to have someone monitor the system and respond to issues that arise. If a resource stops functioning intervention may be required to restart it for example. Monitoring and code maintenance costs are reflected in the graph as if outsourced to a third party support organization.
- iii. Backup and archives - For each size scenario there is an estimate of the size and number of backups required for safety and archival purposes and cost is computed based on the costs of Azure disk storage. This is in addition to SQL Azure's built-in functionality for maintaining data availability by replicating multiple redundant copies of your live data to multiple physical servers.

The system sizes in the graph are arbitrarily labeled Small, Medium and Large. Each size reflects different levels of resource requirements. The resources in each size level are matched. In our 'Large' system with 4 CPUs, for example, we assume 50 GB of SQL disk space and relatively high demands for bandwidth, compared to a 'Small' system with one CPU and 1 GB of SQL disk space which requires less bandwidth.



**Figure 8** – Monthly operating cost examples for running a Cloud ERP system on Microsoft’s Azure PaaS platform (Nov 2010): Small system, \$274/month; Medium system, \$667/month; Large system, \$1484/month. Includes everything ‘as a service’ except the cost of the ERP application license itself.

How does it compare to buying my own ERP servers? It is amazing to see that for \$105.55 per month on Azure we can replace an on-premises database server and an application server, the electricity to keep them running, the UPS, the disk drives, and maintenance. We also don’t have to pay for the Windows operating systems, and the SQL server database license, and for their patching. We also don’t have to allocate any of our on-premises bandwidth to connect these servers to the Internet. On top of this, the Azure system will be more reliable and physically secure, our data will be safer and our users will have a more consistent experience during peak periods. If there is a hardware failure, on Azure we can be back up in minutes, whereas on-premises – who knows? Azure clearly illustrates the point that Cloud Computing gives you more for less.

How many users can it support? There is no limit on the number of authorized users with any of the configurations in the chart, and there is no cost to add a user other than the computing resources required during the moment the user is actually updating or reading from the system. This is one of the big benefits provided by stateless applications. Unlike client-server systems, there is no memory or process thread dedicated to a user unless the user is performing some action. Our concern

then is to have enough resources available to support peak simultaneous requests, including those for longer running processes such as report generation.

Cloud ERP software vendors can usually help you determine the proper amount of computing resources to use as a starting point. The good news is that the risk of sizing a cloud-based system is reduced because resources can be added and dropped quickly, with no capital expense, based on real-world experience.

2. **SaaS** – enables businesses to completely outsource the responsibility for the technical operation and maintenance of a cloud-based ERP system. The real benefits of SaaS come from being able to focus on your business while letting an expert organization focus on running your ERP system. Because web access often means more users, 24 x 7 operations and new security concerns, SaaS can reduce risk if your organization does not have the expertise or capacity in these areas.

SaaS is generally promoted as ‘pay as you go’, with lower costs up front because software licenses do not have to be purchased. With ERP and Accounting SaaS however these savings are significantly offset because a large percentage of up-front costs are not for licenses, they are for switching costs for things like data conversion and validation (historical totals have to match the old system!), procedure changes, and custom report definitions. Because these non-license costs vary significantly from one company to the next, each business should do its own cost calculations as there is no one right answer.

*“The real benefits of SaaS come from being able to focus on your business while letting an expert organization focus on running your ERP system.”*

SaaS is also promoted as saving time in implementation because no hardware or infrastructure software need be purchased or setup. While true, this type of savings is not limited to just SaaS for cloud-based applications that offer alternative deployment options. Amazon Web Services, Rackspace Cloud, Microsoft Azure and other types of PaaS and IaaS also eliminate the need to purchase and maintain hardware and infrastructure.

ERP systems generally last 7 years or more, yet SaaS vendor contracts typically do not lock in pricing for more than one or two years at a time. This means customers must re-negotiate renewals with SaaS vendors prior to the normal end of the systems life. At renewal time SaaS vendors have pricing leverage because switching costs for the customer are very high. What sounds like a great thing when initially buying i.e. "no commitment, pay as you go", may turn out to be extraordinarily expensive if your only two renewal choices are between accepting a too-high increase and starting all over again with another system. From a vendor viewpoint future costs are unknown so committing to prices for more than a year or two is risky. One solution would be to select a SaaS vendor that also provides a non-SaaS option (i.e., on-premises or hosted deployment) which enables use of the same cloud-based application under a more traditional software license agreement, and where support and hosting can be purchased from multiple competing sources.

SaaS ERP, Accounting and CRM products generally fall into one of two major camps: SaaS-only, or SaaS-as-an-option; the difference being SaaS-as-an-option products can also be licensed to run on-premises and in other environments controlled by the customer. The choice nowadays by a SaaS vendor to offer SaaS-only or SaaS-as-an-option is mainly a business decision.

- a. **SaaS-only** – Some SaaS-only ERP and CRM products run in highly proprietary systems where multiple customers share the same application process on a large (often non x86) computer. Data for many companies is kept in a single large SQL database. While the total cost to build and maintain a proprietary multi-tenant platform is very high, the incremental cost to add a customer is low. Early SaaS entrants built proprietary systems because at the time (late 1990's) there was no economic alternative. Because most proprietary SaaS platforms do not cost effectively scale-down, they cannot realistically be offered to customers for self-deployment.

Most SaaS vendors today, however, externally host their applications in large multi-billion dollar hosting facilities run by 3<sup>rd</sup> parties and use standard cloud technologies. This enables even small SaaS providers to be competitive from a cost of computing standpoint and due to the efficiencies of multi-tenancy.

One advantage the SaaS-only vendors have is that they can focus their energy on just the one deployment model. This can benefit customers, especially in the case of smaller more specialized ERP and Accounting vendors that have relatively few customers and development resources.

A disadvantage to SaaS-only is that customers typically cannot co-locate and integrate applications from other vendors in the SaaS vendor's LAN. This limits communication rates and introduces some additional security issues. On the other hand connections only have to be "fast enough" and in many cases Internet speeds will be just fine.

SaaS-only products today include Salesforce (CRM), Netsuite (ERP), and SAP Business ByDesign (ERP).

- b. **SaaS-as-an-option** – enables you to deploy ERP cloud-based business applications under various licensing, deployment and support models. In many organizations requirements change over time. For some, on-premises deployment can be a way to get started, but a few years later, SaaS or hosting may be preferable. Other organizations may want to start with SaaS. The benefit of SaaS-as-an-option products is that the cost of switching deployment methods is very low – end users would likely not even notice, since there is no change in application functionality or database structure.

A disadvantage of SaaS-as-an-option products is that vendors must support multiple platforms, requiring resources that SaaS-only vendors do not have to expend.

For organizations that operate worldwide, SaaS-as-an-option may be the only choice if they wish to standardize on a single ERP or CRM system because it may not be feasible or desirable to deploy SaaS everywhere. The further a location is from a SaaS vendor’s datacenter, the slower things will run – at some point a better alternative is to use a mix of SaaS and on-premises deployments of the same application. There are still parts of the world where Internet access is not cost effective or available, and in many cases there are legal requirements regarding data processing and storage that cannot be met by a particular SaaS vendor.

SaaS-as-an-option products include SugarCRM, Microsoft Dynamics CRM, and Acumatica (ERP).

**Comparing ERP license value - PaaS or SaaS?**

Breaking down PaaS costs as we did in Figure 8 also provides a framework for evaluating SaaS costs vs. purchasing (or leasing) a traditional ERP license and self-deploying on PaaS. Assume SaaS vendor A charges \$30,000 per year for an ERP system that includes resources equivalent to those included in the Small system in our previous chart. As shown in Figure 8, the market value of the resources we require is \$3,288 per year (\$274 per month x 12 months) leaving \$26,712 (\$30,000 - \$3,288) per year as the implied charge for the ERP software license bundled by SaaS vendor A. Assuming \$26,712 is paid annually for 7 years with a 6% cost of capital, the present value of the software license is \$149,117.

To calculate the comparable present value for a traditional ERP software license from vendor B, we need to determine the up-front cost of the software, plus annual maintenance fees for monitoring, patches and enhancements. Assuming vendor B charges an 18% maintenance fee, the cost of the equivalent traditional license is \$74,379 at purchase, plus annual maintenance of \$13,388 for 7 years. This yields the same \$149,117 present value as the SaaS fee.<sup>23</sup>

**Comparing SaaS and traditional ERP license fees**

<b>ERP system life</b>	<b>Vendor A SaaS (ERP license portion only) / yr.</b>	<b>Vendor B Equivalent one-time license fee + annual maintenance.</b>
<b>3</b>	\$ 26, 712	\$ 48, 207 + 18% /yr.
<b>5</b>	\$ 26, 712	\$ 63, 997 + 18% /yr.
<b>7</b>	\$ 26, 712	\$ 74,379 + 18% /yr.
<b>9</b>	\$ 26, 712	\$ 81,683 + 18% /yr.
<b>11</b>	\$ 26, 712	\$ 87, 069 + 18% /yr.

*Figure 9 – ‘Apples to apples’ comparison of SaaS and traditional ERP license fees with different system life assumptions. The market values of the resources required for running, monitoring, patching and backing up the ERP application are excluded in both cases.*

<sup>23</sup> Use the Excel ‘Goal Seek’ function.

Once we know the point where the costs are equal, the question then turns to which application provides the most value in terms of ERP functionality. If both meet our requirements equally, and we anticipate a system life of seven years, vendor B would be the best choice if it charged less than \$74,379 plus 18% maintenance, and vendor A would be the better choice if B charged more than \$74,379 plus 18% maintenance.

Depending on the license terms, a traditional software license may also have some residual value. A typical requirement is to continue accessing an old system for some period of time after moving to a new system. For example, producing audit, tax backup and other reports from data not in the new system may be required for several years. With a traditional license the application can be moved to a small machine for this purpose. With SaaS, some level of subscription is required to the service for ongoing use of the application.

- 3. Local help.** While many parts of business can be conducted remotely, there are aspects of implementing a new ERP, CRM or Accounting system (cloud-based or otherwise) that work best and at lower cost when working face-to-face. Especially if you are located near a city, meetings between key stakeholders and a knowledgeable consultant at your location can often communicate volumes of information more effectively than phone or web meetings. Much training can be done via the web, but tweaking for the specific aspects of your business can often be done better in person where a consultant can see things first-hand. And finally, establishing personal relationships can pay off in times of difficulty should some unexpected thing happen. So even if you only intend to implement as SaaS, a suggestion is to work with SaaS vendors that can cost effectively consult with you at your location beyond just the sales process.

## So what is the bottom line?

*For developers* - Cloud Computing changes the rules for developers of ERP, CRM and Accounting systems. There is really no good way to migrate an old ERP system so it is cloud enabled – at some point you just have to start over ‘from the ground up’ with a new design.

*For support organizations* – Cloud Computing represents a huge technology shift and opportunity for you to add value. Regardless of the deployment type, (on-premises, hosted or SaaS), your customers need on-site, face-to-face implementation consulting services, conversion help to move off their old systems, process consulting, and customization help.

*For business* – It’s bigger than you think. Cloud Computing is not just about using applications over the Internet, or SaaS. Cloud Computing is the next generation of Computing. Even if you are just interested in computing on-premises, Cloud Computing technologies will change everything about how you do it and give you more for less.

Cloud Computing helps you get the friction and delay out of your business processes. You can work from anywhere, using a variety of devices. The web standards used in Cloud Computing enable fast web-browser-based interfaces and low cost integrations between business applications. Cloud-based ERP, Accounting and CRM applications can be deployed inexpensively under a variety of licensing and service models.

There is a growing list of vendors with ERP, CRM, Accounting and other database-oriented business systems designed specifically for Cloud Computing. Given the long life of most business applications, it’s worth taking a good hard look at cloud-based solutions before making a decision.



**About the author** – *John S. Howell, Jr. has 30 years of experience in business software development. He helped build Solomon Software, Inc. to be the largest privately held ERP software company in the USA. In 2000 Solomon merged with Great Plains, Inc. and the combined entity was acquired by Microsoft. At Solomon, Mr. Howell was President and CEO of the International division for 10 years, and prior to that he was Worldwide VP Sales and Marketing at Solomon. Mr. Howell is currently on the board of Acumatica, a developer of ERP and CRM software. He can be contacted at: [jshowelljr@gmail.com](mailto:jshowelljr@gmail.com)*

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