

Analytical Study of Cloud ERP and ERP

Rahul Pareek

(BCA,MCA,MCTS)

Sinhgad Institute of Management, vadgaon(bk),Pune,India

rahulpareek2440@gmail.com

Abstract: Cloud based ERP system architecture provides solutions to all the difficulties encountered by conventional ERP system. It provides flexibility to the existing ERP systems and improves overall efficiency. This paper aimed at comparing the performance traditional ERP systems with cloud base ERP architectures. The challenges before the conventional ERP implementations are analyzed. All the main aspects of an ERP systems are compared with cloud based approach. The distinct advantages of cloud ERP are explained. The difficulties in cloud architecture are also mentioned.

Keywords: ERP, Cloud ERP, Cloud Computing.

I. INTRODUCTION:

ERP: Enterprise Resource Planning System (ERP) is integrated information system with centralized database, which supports main business processes across organization.[1] These systems are among most complex software solutions ever built, and are equally expensive.[2] Traditional SaaP (Software as a Product) on-premise ERP systems imply significant investment in hardware infrastructure and purchasing software licenses. In addition, implementing ERP system in enterprise is costly, time-consuming, high risk process that extends over several years, and it often requires business process reengineering.

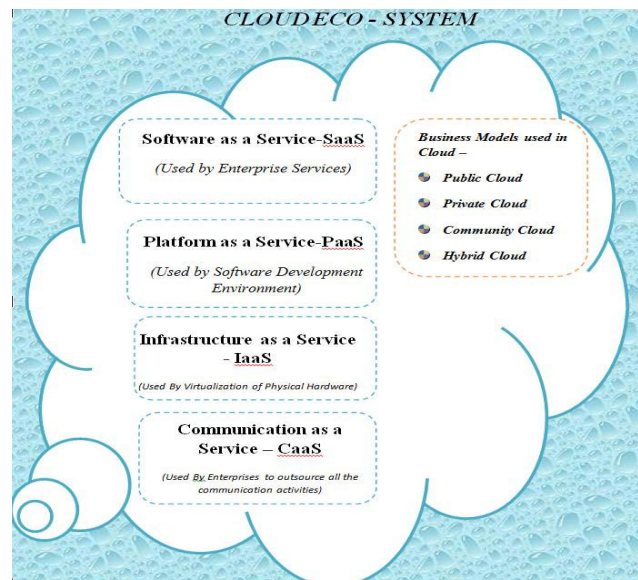
Cloud Computing: According to the National Institute of Standards and Technology (NIST), as it covers, in our opinion, all the essential aspects of cloud computing:

[3]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.

[4]Cloud computing employs a service driven business model. Cloud offers services that can be grouped into the following categories

- Infrastructure as a service (IaaS): Hardware resources (such as storage) and computing power (CPU and memory) are offered as services to customers. This enables businesses to rent these resources rather than spending money to buy dedicated servers and networking

equipment.. As examples in this category, Amazon1 offers S3 for storage, EC2 for computing power, and SQS

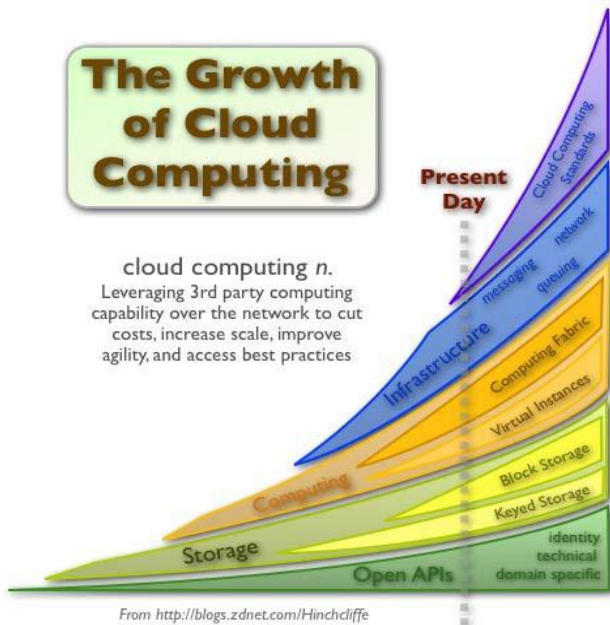


for network communication for small businesses and individual consumers.

- Software as a service (SaaS): In this model, software applications are offered as services on the Internet rather than as software packages to be purchased by individual customers. One of the pioneering providers in this category is Salesforce.com offering its CRM application as a service. Other examples include Google web-based office applications (word processors, spreadsheets, etc.).

The Growth of Cloud Computing

cloud computing n.
Leveraging 3rd party computing capability over the network to cut costs, increase scale, improve agility, and access best practices



(SaaS) for customers who want to acquire ERP without managing hardware, software, and upgrades while reducing up-front expenses. Customers can build and internal cloud to reduce ongoing hardware costs while maintaining greater control over integration and requires local access to their data server.

Summary of Major Vendor Emphasis

	Build Private Services	Deliver Services	Services Delivered*			Private Offerings	
			IaaS	PaaS	SaaS	Enabling Tech.	Packaged Cloud
Amazon	○	●	●	○	○	—	—
salesforce.com	○	●	○	●	●	—	—
Google	○	●	○	○	●	—	—
Microsoft	●	●	○	●	●	—	●
IBM	●	○	○	○	○	—	●
VMware	●	○	○	○	○	—	●
Oracle	●	○	○	○	○	—	●
SAP	○	○	○	○	○	—	—
HP	●	○	○	○	○	—	●

Note: This is not an evaluation of capabilities, but rather of emphasis.



* The provider may offer public, community or virtual private services

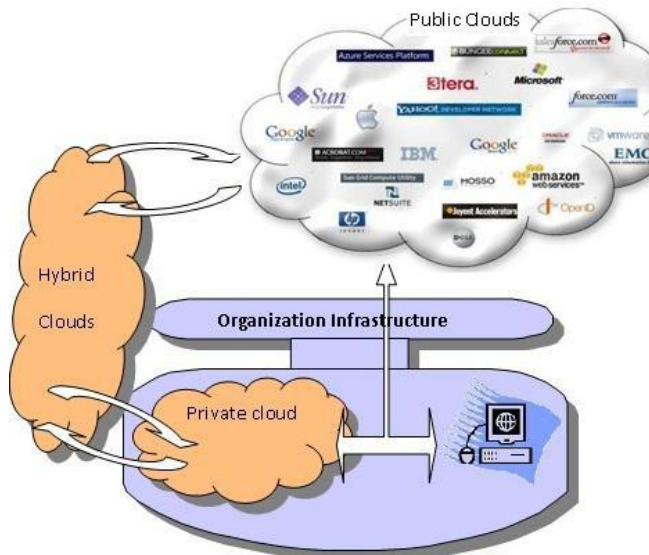
Gartner

- Platform as a service (PaaS): This refers to providing facilities to support the entire application development lifecycle including design, implementation, debugging, testing, deployment, operation and support of rich Web applications and services on the Internet. Most often Internet browsers are used as the development environment. Examples of platforms in this category are Microsoft Azure Services platform6, Google App Engine7, Salesforce.com Internet Application Development platform8 and Bungee Connect platform9. PaaS enables SaaS users to develop add-ons, and also develop standalone Web based applications, reuse other services and develop collaboratively in a team.

Software-as-a-Service (SaaS) often referred to as

on-demand or hosted applications which can be used in the enterprise resource planning systems. SaaS vendor advertently takes responsibility for deploying and managing the IT infrastructure (servers, operating system software, databases, data center space, network access, power and cooling, etc.) and processes (infrastructure patches/upgrades, application patches/upgrades, backups, etc.) required to run and manage the full solution. Software as a service features a complete application offered as a service on demand. A single instance of the software runs on the cloud and services multiple end users or client organizations.

Software-as-a-Service (SaaS) may be described as a Process by which Application Service Provider (ASP) provide different software applications over the Internet leveraging cloud infrastructure on “pay-as-you-go” pricing structure. This makes the customer to get rid of installing and operating the application on own computer. It also eliminates the tremendous load of software maintenance; continuing operation, safeguarding and support. The great benefit of SaaS is the ability to run the most recent version of the application. The SaaS software model has fixed financial and operative advantages over the others in on-campus software Models. The operation cost is very less and the subscription cost is also low normally far cheaper than a licensed application fee which is possible due to its monthly fees based revenue model. With SaaS Architecture, a provider licenses an application to customers on subscription based service delivery. It allows customer to require a computer or a server with internet access to download the application and utilize the software, which make customer to get rid of purchasing expensive hardware / software to run an application. It also allows the software to be licensed for either a single user or for a whole group of users. SaaS has now become common by business for tasks such as ERP, CRM, Computerized HR, Invoicing, Service Desk Management, Procurement, Workflow systems, Document Management etc.



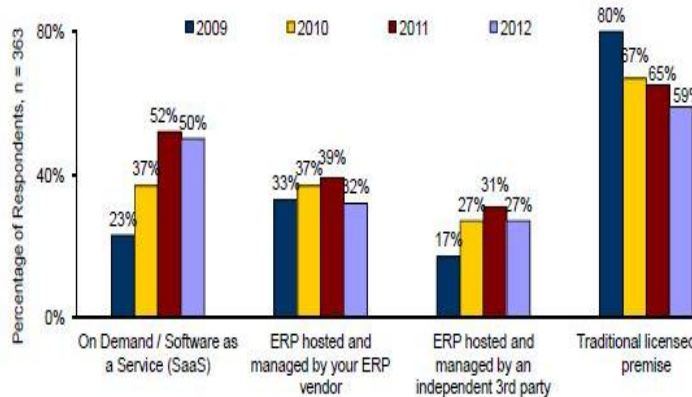
Cloud ERP: ERP software that is deployed into a cloud environment becomes "Cloud ERP Software". Most (if not all) cloud environments are built using virtualization and load balancing technology that allows applications to be deployed across multiple servers and database resources.

Cloud ERP is positioned as a revolutionary approach to deploy an ERP solution. It provides a solution that is flexible, adaptable, scalable, efficient and affordable. Cloud ERP as a business management software has provided big success to deliver business critical data. ERP software as a service

II. SCOPE

The future of Cloud ERP is going to be an exciting

one. The next five years will be very exciting as more and more providers and customers transitioning to Cloud ERP and as a result, many legacy systems will likely be retired. Software that is running on old platforms will begin to disappear. Cloud updates and version controlling happens so fast and so regular. No more waiting for disks and announcing downtime to your users while you test, load, and then patch updates. The end user will authenticate and confirm that the system is fit for their purpose and will make an efficient use of the system.



III. ERP v/s CLOUD ERP

FACTOR	ERP	CloudERP
Deployment	Local Server	Cloud Server
Reduced server cost	Low costs	High costs
Defining business flow	Defined by ERP developer and business organization specific.	Define by both, ERP developer and Business organization.
Implementation costs	High	Low
Ongoing costs	Relatively high	Low
Control over ERP	Easily controllable	Relatively tough to control.
Integration	Dependent on vendor	Can be supported centrally
Licensing costs	High	Low
ERP module update	Costly	Low cost
Internet needed	No	Yes
Version controlling	Complex	Easy

Features	Software as a Service	On Premise
Pricing Information		
Licensing Model	Subscription plan (monthly, annually, etc.)	One time price
Licenses	Typically a per user price	Typically a set number of users are included
Startup Cost	None	High. Have to pay for the software, licenses, support, additional hardware
Support, Updates & Security		
Support	Typically included in the price	Extra cost
Updates	Updates usually included in the subscription price and more frequent updates	Extra cost and less frequent updates
Data Security	Vendor is responsible for security. Usually have a highly secure data center	The user's responsibility. You keep your data in your server
Compatibility		
Supported Platforms	All Operating Systems with access to the Internet	Windows computers are the norm
Integrations	Hard to integrate to existing company software	Integration is easier
Features		
Features	Feature set is usually less robust	Feature set is usually more robust
Collaboration	Collaboration is easier and more streamlined; great for remote users	Collaboration can be difficult especially for remote users

i. Capital Cost:

Cloud based systems are becoming more popular because of the flexibility it offers. Cloud gives the firms all the service of computing, networking and storing from distinct location. It avoids the infrastructure cost of the companies. The maintenance is taken care by the provider. The companies need not required technical abilities to maintain the systems and software packages. The capacity of the cloud based systems can be easily increased without disturbing the existing services. All the software run on top of the cloud. These abilities of cloud technology offer lot of advantages. The cost of ERP implementation is significantly reduced by introducing the cloud based approach.

ii. Cloud Services:

Cloud based systems are generally sub divided into three types based on the services provided. the three types are Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). The ERP implementation based on cloud services is grouped under SaaS. ERP is end user business. The platform based cloud is a middle ware application provided by distance provider. Hardware services are provided by infrastructure services. Based on the access types the cloud can be divided into two types private and public systems. Private systems are accessed and managed by the company; it will not be accessible to the customers directly. Public cloud systems are accessed by anyone and the customers can directly access the systems. Even a hybrid cloud can be implemented to cater the needs of the companies which offer online services [5]. The hardware of the hybrid cloud is maintained by companies, but the data is outsourced. Cloud ERP systems are accessed via common browser over internet connection and allow the user to get all the information through client configuration. ERP is based on public cloud approach. The service based cloud implantation provides offerings in the form of services and the public nature gives the key components of software to the users.

iii. Advantages of Cloud Based ERP:

The cost of the cloud based ERP implementation is lower compared to the traditional implementation. The cost of energy and maintenance, configuration etc is reduced. The scalability feature of cloud based ERP is enormous. The elasticity of the cloud based approach is one of the main advantages. The flexibility of cloud ensures competitive

advantages to a particular company. Another advantage is faster implementation of software. Any changes suggested by the consumer can be implemented easily. The companies are free to concentrate on their improvements without thinking about the software

Implementations. Resource sharing and allocation becomes a very difficult task in the host based ERP systems. In cloud systems all the difficulties are handled care by the providers [6]. Migrating to a new technology or software is simpler in cloud based applications.

The various advantages of cloud are:

Self-service Provisioning- Allows users to deploy their own sets of computing resources (machines, network, storage, etc.) as needed without the delays and complications typically involved in resource acquisition; IT supports ongoing customization and enhancement of cloud user experience, while monitoring, managing, and expanding as required the underlying cloud infrastructure.

Scalability- Decouples the fluctuating needs of individual users from typical infrastructure constraints, thus easily accommodating rapid increases or decreases in resource demand.

Reliability and fault-tolerance- IT can focus on improving critical pieces of infrastructure to achieve predetermined levels of reliability. Policies addressing expected levels of reliability can be continuously reassessed and updated without user involvement.

Optimization/Consolidation- Maximizes the usage and increases the efficiency of existing infrastructure resources. Extends infrastructure lifecycle. Reduces capital expenditure.

QoS (Quality of Service) - Allows IT to dynamically reassess the SLA associated with users or groups of users for the resources allocated. Allows the organization to react quickly to changing conditions without unnecessary user involvement or knowledge.

As-needed Availability- Aligns resource expenditure with actual resource usage thus allowing the organization to pay only for the resources required, when they are required.

Ease of Use - Through hiding the complexity of the infrastructure (including management, configuration etc.) Cloud can make it easier for the user to use ERP based cloud, as well as reduces the overhead for controlling the system.

Location independence: services can be accessed independent of the physical location of the user and the resource.

Data Management - As size of data may change at any time, data management addresses both horizontal and vertical aspects of scalability. User need not worry about the database backups.

iv. Disadvantages of Cloud Based ERP:

Data security- Security on the cloud environment is a concern and each delivery and deployment models require different levels of security because of different characteristics. Different deployment models like public cloud, private cloud, and hybrid cloud require different security applications. Regarding data security, basic components of system security such as data integrity, availability and confidentiality are always an issue.

Only having a system within safe walls and no internet connection at all to the outside might be more secure today. However, it is not a case anywhere today.

Each company and organization has a different requirement when applying security components for their systems. However, this public organization's data is kept by applying public security policy, which requires of enabling some personal and company data publicly available. These statements confirm the importance of data security in both traditional ERP and cloud ERP environment. There is a need for security standards for being able to prove data security.

System architecture- Cloud computing and ERP have different system architectures. It is a security issue for Cloud Computing and Cloud ERP.

“Cloud based services are more customizable and flexible then on-premise solution offers. The main Difference is that you get so much more from the cloud-based solutions. For example, maintenance, Upgrades, top of the line security, flexibility and availability all bundled together. Since the conventional ERP is suffered from the complex architecture because of the modules that are Integrated all together, cloud ERP might have similar problems. However, cloud environment has Another issue to consider regarding the architecture, which is multitenancy. System architecture, especially multitenancy is the most important thing for cloud Based ERP services.

Authentication and authorization – The importance of access control of the system such as How crucial is to establish a well-established access control system for their ERP. Managing the access control is an issue for every system and access control should follow some rules and policies that depend on company's security requirements. Even the public agencies have some access control applications in their system, which also required of compliance to the public security policy.

Some other disadvantages:

- Financial Data part of the Cloud ERP system – Can you trust your provider?
- Integration to other systems may be more difficult.
- Higher costs of Internet bandwidth.
- Indirect access to your data – will likely have to use an API rather than direct data access.
- Full backups will be dependent upon pulling data down from the cloud, thus possibly resulting in less frequent backups.

IV. SERURITY

Cloud Based ERP Security Layers and Deployment Model

Cloud security needs to be enforced at the Physical, Network, Data and Application level. Since social engineering is on the rise, while providing physical security, the cloud provider must define and enforce rules of conduct and social guidelines for employees. Network security should protect all virtual access points to the cloud by employing well-managed security rules and procedures to block attacks. Data security should ensure that both the data in storage as well as data in transit are protected from unauthorized third parties. Since most applications are built to be run in the context of an enterprise data center, the lack of physical control over the networking infrastructure might mandate the

use of encryption in the communication between servers of an application that processes sensitive data to ensure its confidentiality. [Savage, (2011)] Literature reveals that many organizations are migrating their on-premise enterprise systems to Cloud based

Software-as-a-service (SaaS) enterprise system. ERP.com claims that cloud-based enterprise systems are easier to use, deploy and maintain, thus further reducing the time and cost of meeting specific business needs and stay competitive in the market [Rich, (2010)]. In a 1999 article that described issues surrounding ERP implementation, the authors have mentioned that the process often takes more than 3 years [Bingi et. al., (1999)]. Traditional implementation often runs into millions of dollars [Seddon et al, (2010)]. This trend appears to be changing. In a recent blog post describing trends for ERP in 2011, ERP consultant Eric Kimberling predicts a “heavy adoption of Software-as-a-Service [SaaS] models at small and mid-size businesses” [Kimberling, (2011)].

Proposed Security Framework Components

Literature reveals that many organizations are adopting cloud-based enterprise systems in the present scenario. But at the same time the enterprises should be convinced that security is not a threat for their implementation. Hence this study has been under taken to propose a framework to enhance the security. Fig.1 represents the components of the proposed security frame work for cloud-based enterprise systems.

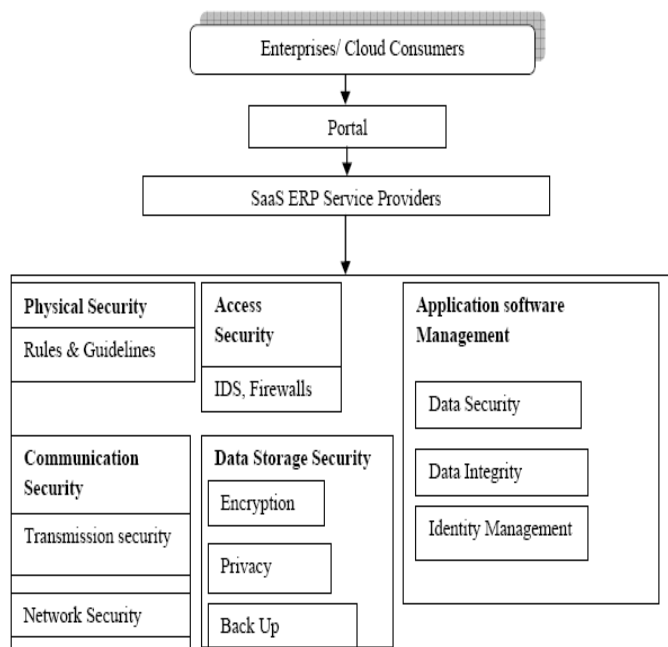


Fig 1. Proposed Security Framework for Cloud Based Enterprise Systems

a) Physical Security Management Module:

When an organization has its application running in an external cloud, the physical environment is off premise. A violation to physical security means that an unauthorized user with malicious intent has physical access to the hardware where either the application is running or data is stored. The physical security component must define and enforce rules of conduct and social guidelines for employees and have mechanisms to ensure that the rules are being adhered to. Also

the component must include the solutions for disaster recovery.

b) Data Storage Security Management Module:

When ERP data is accessed by users, the business logic available in the system must ensure that only authorized users are able to access the data and that there is clear segregation of data stored by different users. The system also has a provision for backing up the data to aid in instances of disaster recovery. To carry out its tasks, the module may include the following three components:

- **Encryption Component:** Sensitive data should be encrypted when it rests in the database or in a file system. This prevents direct access to data and ensures that all accesses are filtered by the application logic. The encryption component can use the public-key or private-key encryption techniques to secure the sensitive data Resting in the cloud. The component should also include the business logic to ensure that if there is any required data indexing, then it is not broken in the encryption process. The encryption and decryption process creates processing overhead and hence non-sensitive data should be stored in the clear to minimize costs.
- **Privacy Component:** One of the major characteristics of cloud computing that has led to its acceptance is multi-tenancy which permits multiple users to simultaneously store their data in the same location using the applications provided by SaaS. In such a situation, intrusion of data of one user by another user becomes possible. This intrusion can be done by exploiting the loop holes in the application such as vulnerable virtual machine images or by injecting client code into the SaaS system. The Privacy component should therefore ensure a clear boundary for each user’s data [Subashini and Kavitha, (2010)].
- **Backup Component:** In a cloud based enterprise system, the SaaS vendor needs to ensure that all data owned by a particular enterprise is backed up on a periodical basis which can be of use in disaster recovery. The component can further secure the backed up data by storing it in an encrypted form which prevents accidental leakage of sensitive information.

c) Access Security Management Module:

Access security violations can happen from internal as well as external sources. Internal access Security is required to prevent illegal users from accessing resources and sending unauthorized queries to servers. The lack of proper implementation of access security could impact the availability of an application by authorized users such as in the case of a Denial of Service (DoS) attack. The access security module should have an Intrusion Detection Mechanism (IDS) to guard against such attacks. The module should have various perimeter security devices such as firewalls and must ensure that the various security policies put forward by the organization are incorporated and adhered to.

d) Application Software Management Module:

This module contains the business logic that ensures the security and integrity of data. The module also includes mechanisms for authenticating the users for providing services. The business logic included in the module also does the task of identity management. The various components of the module include:

- **Data Security Component:** In the SaaS model, the enterprise data is stored outside the enterprise boundary at the SaaS vendors end. Data security mechanisms limits access to data objects to specific individuals. The data security component may enforce data security for ERP systems either through business logic or at the database layer. The business logic applied for data security authenticates users and provides them with specific rights to data objects and controls the specific actions that individual users can perform on different objects. The component should support different level of security such as read-only, insert, delete and edit according to the role of the user and the type of object. The component should include mechanisms to protect against attacks such as Cookie manipulation, Cross-site scripting (XSS), Hidden field manipulation etc. [Bhadauria et al. (2011)]

- **Data Integrity Component:** Maintaining data integrity ensures uniformity in the different instances of same data residing at multiple locations. The integrity component should ensure that the integrity of enterprise's data stored in the database in cloud is not compromised.
- **Identity Management Component:** Identity management involves identifying individuals in a system and filtering the access to the resources in that system by placing restrictions on the established identities. The identity management component may follow credential synchronization model to support identity management and sign on services [Subashini and Kavitha , (2010)]. In this model, the SaaS vendor supports replication of user account and SaaS application. The user account information creation is done separately by each enterprise within the enterprise boundary to comply with its regulatory needs. Relevant portions of user account information's are replicated to the SaaS vendor to provide sign on and access control capabilities. The Identity management module must contain mechanisms to ensure security of the credentials during transit and storage and to prevent their leakage.

e) **Communication Management Module:** In a cloud-based enterprise system, the sensitive data is obtained from the enterprises, processed by the SaaS application and stored at the service provider's end. The communication management module assures the security of the information that gets communicated in the cloud environment either within a network or across networks. A participant in a cloud environment is more difficult compared to an on-premise environment. Security of transmitted data can be achieved through encrypting all communications from the source to destination using encryption algorithms such as DES, Triple DES, RSA etc.

- **Network Security Component:** Applications running in an external cloud environment requires passing data between the cloud and the user location. Frequently the communication occurs over the Internet and over Wireless networks. The network security component of the security framework can use strong network traffic encryption techniques like Secure Sockets layer (SSL) and Transport layer security (TLS) to protect all communications with the server. The SSL algorithm is supported by all major browsers and requires less computing

overhead. SSL encapsulates application specific protocols like HTTP to form HTTPS and hence none can hijack a session or read the data. The network security component may include tests that check for various security threats such as network penetration and packet analysis, session management weaknesses, Insecure SSL trust configuration.

V. List of Top 7 Cloud ERP



Blue Link ERP

Blue Link ERP is a robust Distribution ERP system with powerful inventory management and accounting features including landed cost tracking, lot tracking and barcode scanning. It is a great fit for small to mid-sized businesses.



Intacct Financials and Accounting System

With a highly accessible web-based architecture, Intacct offers a comprehensive Enterprise Resource Planning (ERP) solution built on their industry-leading financial software. Intacct supports more than 30,000 users worldwide.



Microsoft Dynamics GP

Microsoft Dynamics GP supports more than 40,000 customers. It is a feature-rich system with hundreds of industry-specific add-ons from Microsoft partners.



NetSuite

NetSuite is a 100% web-based system. It's a complete suite with integrated business intelligence, inventory management, accounting and other applications.



Oracle JD Edwards

JD Edwards became a part of the Oracle family of applications in 2005. The system is offered in an on-premise and a web-based version and includes human resources, business intelligence and inventory management functionality.






SAP Business ByDesign

Released in July of 2010, SAP already has more than 500 customers using Business ByDesign to run their operations. The software is offered as a service (i.e SaaS) and pricing is based on a monthly or subscription basis.

SAP Business All-in-One

SAP Business All-in-One is supported by more than 1,100 SAP partners across 50 countries. The accounting and business intelligence applications are offered on a best-of-breed basis while inventory management is part of the suite.

Some Cloud ERP Vendors Details:

									
	Free Demo	Free Demo	Free Demo	Free Demo	Free Demo	Free Demo	Free Demo	Free Demo	Free Demo
General Data									
Product Name	NetSuite	SYSPRO	Plex Systems	Epicor ERP	Sage ERP X3	EnterpriseIQ	Infor VISUAL	IFS Applications 8.0	Enterprise 21 ERP
Version	Always Current	7.0	Always Current	9.05	6.4	2012	6.5.4	8.0	8.1
Price Range	\$10K-100K	\$20K-500K	\$5K + per month	\$4K-500K	\$2600/ user	\$20K+ and up	\$12K-100K	\$300K-2M	\$30K-\$750K
Financing Options	Subscription	Lease, Owner Financing	Subscription	Lease, Owner Financing, Lease to own		Lease, Financing	Lease, Owner Financing, Lease to own	Lease, Owner Financing	Lease, Interest Free Financing
User Range	10+unlimited	4-1000	20-1000+	1-1000+	20-1000+	5-Unlimited	5-500	40-5000	5-1000+
Multi Site	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Multi Country		Yes, 60+ Countries	Yes	Yes	Yes	yes	Yes	Yes	English / Spanish
Architecture	SAAS, Multitenant	SOA, XML, Webservice	SaaS Multitenant SOA	SOA		SOA, .NET	SOA	SOA	SOA
	MS SQL Server, Progress, IBM DB2, Other, Oracle, ODBC Compliant, Proprietary, Customized per Client, Pervasive, Power, Sage		MS SQL Server, Progress, IBM DB2, Other, Oracle, ODBC Compliant, Proprietary, Customized per Client, Pervasive, Power, Sage				MS SQL Server,		MS SQL Server, Progress, IBM DB2, Other, Oracle, ODBC Compliant, Proprietary, Customized per Client, Pervasive, Power, Sage

Conclusion:

In this paper attempt has been made to compare all aspects of traditional ERP systems with cloud based ERP architecture. The flexibility offered by cloud ERP systems explained. Any improvements in the systems after complete installation are easy in cloud ERP. All the data stored at different locations can be easily grouped together. Reports can be generated and analyzed efficiently. All the applications can be integrated and maintenance becomes simple. The companies are free to concentrate only on core competencies. All the other details can be presented by the providers. To ensure the successful implementation of ERP systems; we have to constantly improve the system. Security challenges faced by cloud based systems needs to be addressed for the successful implementation of SaaS enterprise systems. A security framework has been designed for providing better security for cloud based enterprise systems.

The proposed framework tries to address the security issues faced by these systems.

References:

- [1] http://en.wikipedia.org/wiki/Enterprise_resource_planning.
- [2] Mary Sumner Enterprise, 2004. Enterprise Resource Planning. Pearson.
- [3] Michael Armbrust, ArmandoFox, ReanGriffith, Anthony D. Joseph, Randy H. Katz, Andrew Konwinski, Gunho Lee, David A. Patterson, Ariel Rabkin, Ion Stoica, Matei Zaharia, 2009. Above the Cloud: a Berkeley view of Cloud Computing. Electrical Engineering and Computer Sciences University of California at Berkeley.

[4] Mark I Williams, 2010. A Quick Start Guide to Cloud Computing: Moving Your Business into the Cloud (New Tools for Business,Kogan page.

[5] N. Ram Ganga Charan, S. Tirupati Rao , Dr .P.V.SSrinivas , Deploying an Application on the Cloud, International Journal of Advanced Computer Science and Applications, Vol. 2, No. 5, 2011.

[6] K Mukherjee, G.Sahoo , Green Cloud: An Algorithmic Approach, International Journal of Computer Applications(0975 – 8887) Volume 9, No.9, November 2010.

[7] Marnewick, C. and Labuschagne, L. (2005). “A security framework for an ERP system”. Conference proceedings of the Information Security South Africa. Conducted by ISSA. Johannesburg: ISSA.

[8] A. Kulshrest, Project lead in TCS , Conversation in May 2013, Cost of ERP SaaS Vs cost of ERP onpremises:user’s based practical example.

Author Profile



Rahul Pareek received the B.C.A from Lucky Institute of professional studies, Jodhpur (Raj.) and pursuing M.C.A degrees from Sinhgad Institute of Management, Pune in 2012 and 2015, respectively. He has also done Microsoft Certification in .Net 3.5 and is MCTS.