Enterprise Resource Planning in Cloud Computing
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Abstract— Enterprise Resource Planning System is being used in different industries over a decade. In this paper, we have made an attempt to study implementation of enterprise Resource Planning in Cloud Computing. ERP System is becoming standard in business process and activities. Enterprise Resource Planning (ERP) system attempts to integrate data and processes in organizations. The data is stored in single database. In this, the ERP and Cloud Computing are defined as a joint system, using their specification and focusing on organizations specification. In this, we have covered different aspects of ERP System and later Cloud Computing and its future, Cloud ERP and their implementation.

Key words: Enterprise Resource Planning, Cloud Computing, Cloud ERP, Benefits and drawbacks

I. INTRODUCTION
According to the Wikipedia definition, ERP includes a wide range of different activities that lead to improved performance of the organization and all data and processes of an organization are collected in single system. ERP in organization causes great improvement on different aspect of organization work, which includes Human Resources, Sales and Marketing, Planning Management, Finance and Accounting, Customer Relationship Management (CRM). ERP software brings users economic benefits during a company’s operational management. The economic benefits of ERP users are better than the non-users. All the data and information resources are managed by Enterprise Resource Planning Systems in the business organizations. ERP system was introduced in the late 1990’s. ERP system is integrated information system with centralised database, supporting business processes in organization.

These systems are one of the most complex software solutions built and are expensive. The efforts put in the fields of computer science and business management to produce an IT platform which helps in combining all the essential business logic is known as ERP system. Enterprise Resource Planning (ERP) system attempts to integrate data and processes in organizations. The data is stored in single database. This database function as a hub that stores, shares and circulates data from within the different departments and business function. ERP systems are one of the most adopted information technology (IT) solutions in organizations.

Cloud Computing is computing in which large groups of remote servers are networked to allow the centralized data storage, and online access to computer services or resources. Cloud Computing promises reliable services delivered through next-generation data centers which are built on computer and storage technologies. Consumers can access the applications and data from a ‘Cloud’ anywhere in the world on demand. Google Maps, Google Apps, Gmail, etc. are all based on cloud.

Cloud ERP is a technology which allows organizations, users or individuals to access and use ERP software installed on client site through internet. The main reasons to consider this are the low entry cost, as no initial investment is required to set up IT infrastructure and pay-peruse model as no license fees needs to be paid up front.

II. ERP SYSTEM – AN OVERVIEW

Enterprise resource planning (ERP) is business management software—typically a suite of integrated applications—that a company can use to collect, store, manage and interpret data from many business activities, including:
- Product planning, cost
- Manufacturing or service delivery
- Marketing and sales
- Inventory management
- Shipping and payment

ERP provides an integrated view of core business processes, often in real-time, using common databases maintained by a database management system. ERP systems track business resources—cash, raw materials, production capacity—and the status of business commitments: orders, purchase orders, and payroll. The applications that make up the system share data across the various departments (manufacturing, purchasing, sales, accounting, etc.) that provide the data. ERP facilitates information flow between all business functions, and manages connections to outside stakeholders.

A. ERP Software Modules

ERP software typically consists of multiple enterprise software modules that are individually purchased, based on what best meets the specific needs and technical capabilities of the organization. Each ERP module is focused on one area of business processes, such as product development or marketing. A business can use ERP software to manage back-office activities and tasks including the following:

Distribution process management, supply chain management, services knowledge base, configure, prices, improve accuracy of financial data, facilitate better project planning, automate employee life-cycle, standardize critical business procedures, reduce redundant tasks, assess business needs, accounting and financial applications, lower purchasing costs, manage human resources and payroll.

Some of the most common ERP modules include those for product planning, material purchasing, inventory control, distribution, accounting, marketing, finance and HR.

As the ERP methodology has become more popular, software applications have emerged to help business managers implement ERP in to other business activities and may incorporate modules for CRM and business intelligence, presenting it as a single unified package.
III. CLOUD COMPUTING – AN OVERVIEW

Cloud Computing, or in simpler shorthand “The Cloud”, also focuses on maximizing the effectiveness of the shared resources. Cloud resources are usually not shared by multiple users but are also dynamically reallocated as per demand. Cloud Computing is computing in which large groups of remote servers are networked to allow the centralized data storage, and online access to computer services or resources. Clouds can be classified as public, private or hybrid. This can work for allocating resources to users. This approach should maximize the use of computing power thus reducing environmental damage as well since less power, air conditioning, rackspace, etc. are required for a variety of functions. With cloud computing, multiple users can access a single server to retrieve and update their data without purchasing licenses for different applications. [11]

Fig. 2: Compute Cloud

A ‘Cloud’ is defined as a type of parallel and distributed system consisting of collection of interconnected and virtualized computers. The idea behind cloud computing is to scale your application by deploying it on a large grid of commodity hardware boxes. The cloud computing consists of three basic elements: a web server/application layer, a distributed storage layer, and a distributed queue layer. Each one of these layers is a cloud itself, which means all are identical and performs the same function. Thus, cloud computing and storage converts physical resources into scalable and shareable resources over the internet.

Cloud Computing has different types of cloud deployment models and different types of services that can be delivered using that model. Cloud computing is a style of computing in which business processes, application, data, and any type of IT resource can be provided as a service to users.

Cloud delivery models can be briefly classified into three types:
- Public: In a public cloud, a business rents the capability and they pay for what they use on-demand.
- Private: In private cloud, a business essentially turns its IT environment into a cloud and uses it to delivery services to their users.
- Hybrid: Hybrid clouds combine elements of public and private clouds.

There is Community Model which are shared by several organizations, they are externally hosted, but can be internally hosted by one of the organization. Within the cloud computing space, there is a spectrum of offering types. There are five commonly used categories. They are:-
- Platform-as-a-Service (PaaS): This is the provisioning of hardware and OS, framework and database, for which developers write custom applications.
- Software-as-a-Service (SaaS): This is the provisioning of hardware, OS, and special purpose software made available through the Internet.
- Infrastructure-as-a-Service (IaaS): This is the provisioning of hardware or virtual computers where the organization has control over the OS, thereby allowing the execution of arbitrary software.
- Storage-as-a-Service (SaaS): This is the provisioning of database-like services, billed on a utility computing basis, for example, per gigabyte per month.
- Desktop-as-a-Service (DaaS): This is the provisioning of the desktop environment either within a browser or as a terminal server.

Fig. 3: Private, Public and Hybrid clouds.

Cloud can be:-
1. Private Cloud
2. Public Cloud
3. Community Cloud
4. Hybrid Cloud
IV. ERP SYSTEM IN CLOUD COMPUTING

Cloud ERP is Enterprise Resource Planning software that is hosted in a platform over the Internet. The use of the term “Cloud” includes a broad set of applications and software deployment models, namely Software-as-a-Service or SaaS.

The ‘Cloud’ provider offers ERP system software solutions to their client. This Cloud ERP falls in Software as a Service (SaaS) cloud services. Cloud ERP is very beneficial as it is adaptable for the organizations and provides profit for development. Cloud ERP is an approach to enterprise resource planning (ERP) that makes use of cloud computing platforms and services to provide a business with more flexible business process transformation.

Cloud based ERP benefits customers by providing application scalability and reduced hardware costs. In addition, Cloud computing technology made it easier to deliver ERP through ‘Software as a Service (SaaS)’ model for customers who want to acquire cloud ERP and not have to manage hardware, software, and upgrades while reducing up-front expenses. Customers can build an internal cloud to reduce ongoing hardware costs while maintaining greater control over integration and require local access to their data server.

Cloud ERP suppliers need to keep updating the IT infrastructure for the client. Cloud ERP suppliers permit your IT assets to concentrate on improving and helping develop the business all the more viably, as opposed to using a disproportionate measure of their time on keeping up and dealing with your on premise framework.

The Cloud Computing is of two types:-

A. Cloud ERP as SaaS:-
In Cloud ERP software are represented as a collection of Software in the SaaS term. It is termed as ERP on SaaS because of the low investment cost in service. In organization, they face limitation in customization of ERP. The service providers have access to all the organizational data. So, they face with security and privacy issues. Some of these include reputation, fate sharing, etc. The security issue can be solved using high privacy setting.

B. Cloud ERP as IaaS:-
In Cloud ERP, ERP is implemented on IaaS provided by Cloud Service providers. The services are located in the organization or it’s located where the provider is located. The organization needs high security. The implementation cost is decreased with the security and privacy settings.

The Cloud service model consists of four groups. It is known as cloud hierarchy with ERP integration. The four groups are:-

1) Public Cloud Deployment Model
2) Private Cloud Deployment Model
3) Community Cloud Deployment Model
4) Hybrid Cloud Deployment Model

C. Cloud ERP has profits clients by giving
Different and vast variety of uses and also has lessened equipment costs. Also, Cloud Computing technology has made it simpler for cloud ERP based websites to convey ERP programming as Software as a Service (SaaS) for clients who need to procure cloud ERP. They don’t need to oversee equipment used for setup, programming, and redesigns while lessening in advance expenditures. Clients can assemble an internal cloud to decrease continuous equipment expenses while supporting more amazing control over coordination or integration and by getting access to their data Server.

V. COMPARISON BETWEEN CLOUD ERP AND ON-PREMISE ERP

A. Cloud ERP:
1) Cloud ERP has lower upfront cost compared to On-Premise. Consistent monthly payments.
2) It is quicker to implement. Quicker to start using.
3) Hardware is taken care of for the organization. No need for internal IT resources to manage it.
4) System is accessed through the web.
5) Flexibility to add/remove users as needed.
6) More bundled service provided by the cloud provider.

B. On-Premise ERP:
1) It has higher upfront cost. Organization can buy and own both hardware and software.
2) Control and flexibility. On-Premise ERP is in same building = more control/flexibility.
3) Lower long term cost. Flexibility to use hardware until you want to change it out. [12]
4) More flexibility. Flexibility to upgrade the business application when you want to. [12]
5) Lower IT costs than with Cloud. Only pay for what you want/need. [12]

VI. BENEFITS AND DRAWBACKS OF CLOUD ERP

A. Advantages:
1) Focus on the core business:
Entrepreneurs that focuses on this principle maintain an unobstructed focus on what mostly matters (e.g. their core competence, expertise, customers, and mission) can reach their goals over their competitors. Business professionals who are weaving cloud computing into their business processes, frequently comment on how they are into a number of businesses such as education, manufacturing, or financial services but they don’t want to be in technology business [9].
2) Increased flexibility:
By adopting SaaS, enterprises can recognize an increased flexibility in their business. One of the great advantages is that outsourcing (which cloud computing and SaaS is sort of it) has brought to enterprises is that it prevents them to become technologically obsolete without having to put large investments in technology [9].
3) Lower IT barriers to innovation:
Cloud computing can lower IT barriers to innovations of businesses since it can be witnessed by a variety [9].
4) Run the business more globally:
In personal communication with the two IS professionals, they believed that adoption of ERP as SaaS helps adapters to run their business more across the national borders while incorporating with international partners [9].
5) Low initiation cost:
Advantage of working with SaaS model is its low initiating cost which specially is suitable for SMEs (Small to Medium Sized Enterprises) that usually lack the wherewithal to set up initial infrastructure in-house [9].
6) Save technology and staff costs:
In SaaS model, service providers dedicate all their capacity and specialties to provision IS (Information System) services which as a result, greater economies of scale can be obtained [9].
7) Easier access to technical expertise of SaaS provider:
The software service is externally and centrally managed by SaaS provider. Users of SaaS have technical experts of SaaS providers at their disposal easier [9].

B. Disadvantages:
Loss of critical resources and capabilities:-One of the other strategic disadvantages that an enterprise may experience when sourcing applications as SaaS is possibility of losing critical resources and capabilities. To put it simply, the more applications support critical functions [9].
1) Paying more than agreed subscription fee:
In order to reach expected level of service Usage of SaaS model can bring a financial uncertainty for SaaS users that they may need to pay more than agreed subscription fee in order to reach expected level of service and they may raise the price for giving better support or even refuse to invest on maintaining backward interfaces compatible with the customized components of the SaaS user [9].
2) Hidden costs in the contract:
Being client to SaaS model may also bring disadvantage of shouldering hidden costs for SaaS users. Usage of SaaS business model, which is considered as type of outsourcing, has some hidden costs [9].
3) Loss of technical knowledge:
When a service such as SaaS is outsourced, users gradually lose their technical understanding of the service over time. Even if the provider delivers innovative services to the users, there still remains a large proportion of new technical knowledge in the hands of provider which cannot be transferred easily to the client [9].
4) Increased security risks:
Risk of SaaS sourcing adoption is security which many authors have ranked it as the primary concern of consumers. The massive concentration of resources and data in resource pool of cloud infrastructure can grab more attention of hackers whereas defences of cloud architecture can be more robust, rigid, scalable and cost-effective against attacks of hackers in comparison to users’ in-house antitank facilities and equipment’s [9].

VII. CONCLUSION

Implementing ERP System in Cloud Computing has solved many problems in the organizations. As ERP System and Cloud Computing have many advantages and fewer disadvantages. The combination of these two technologies helps the organizations to accomplish more productivity and benefit from it. Cloud ERP is nothing more than the ERP hosted on the Cloud servers by the Cloud providers. ERP system has provided benefits to the organization in marketing and sales, inventory management, shipping and payment, cost planning and development and many more whereas Cloud Computing provides flexibility, better reliability, security, unlimited storage. It is required to neglect the obstacles, so that we can benefit from it. It is the best way to save time and money and can access and pay only for the needed reliable data storage.

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