Cloud computing notes

The cloud makes it possible for users to access information from anywhere anytime. It removes the need for users to be in the same location as the hardware that stores data. Once the internet connection is established either with wireless or broadband, user can access services of cloud computing through various hardware's. This hardware could be a desktop, laptop, tablet or phone. Cloud offers a reliable online storage space. It transfers the processing required to use web applications from the browser as processing is done in the servers of cloud computing. Hence, it is a devise which requires low processing power and low storage capacities. Organizations can choose appropriate technologies and configurations according to their requirement. In order to understand which part of spectrum of cloud is most appropriate, an organization should consider how clouds are deployed and what services they want to provide to the customers. Most cloud computing infrastructure consists of service delivered through common centers' and built on servers. Cloud computing comprises of 2 components "the front end" and the "back end". The front end includes client's devices and applications that are required to access cloud. And the back end refers to the cloud itself. The whole cloud is administered by a central server that is used to monitor client's demands. Cloud computing systems must have a copy of all client's data to restore service which may arise due to system breakdown.

Historical Development:

"cloud computing" concepts date back to the 1950s when large-scale mainframes were made available to schools and corporations. The mainframe's colossal hardware infrastructure was installed in what could literally be called a "server room" (since the room would generally only be able to hold a single mainframe), and multiple users were able to access the mainframe via "dumb terminals" – stations whose sole function was to facilitate access to the mainframes. Due to the cost of buying and maintaining mainframes, an organization wouldn't be able to afford a mainframe for each user, so it became practice to allow multiple users to share access to the same data storage layer and CPU power from any station. By enabling shared mainframe access, an organization would get a better return on its investment in this sophisticated piece of technology.

A couple decades later in the 1970s, IBM released an operating system called VM that allowed admin on their System/370 mainframe systems to have multiple virtual systems, or "Virtual Machines" (VMs) on a single physical node. The VM operating system took the 1950s application of shared access of a mainframe to the next level by allowing multiple distinct compute environments to live in the same physical environment. Most of the basic functions of any virtualization software that you see nowadays can be traced back to this early VM OS: Every VM could run custom operating systems or guest operating systems that had their "own" memory, CPU, and hard drives along with CD-ROMs, keyboards and networking, despite the fact that all of those resources would be shared. "Virtualization" became a technology driver, and it became a huge catalyst for some of the biggest evolutions in communications and computing.

In the 1990s, telecommunications companies that had historically only offered single dedicated point–to-point data connections started offering virtualized private network connections with the same service quality as their dedicated services at a reduced cost. Rather than building out physical infrastructure to allow for more users to have their own connections, telco companies were able to provide users with shared access to the same physical infrastructure. This change allowed the telcos to shift traffic as necessary to allow for better network balance and more control over bandwidth usage. Meanwhile,

Cloud computing is realized through the advent of the Internet. As such, the concept of the cloud is relatively new. The general idea according to Biswas (2011) can be traced to the 1960's when John McCarthy noted, "computation may someday be organized as a public utility." McCarthy's premonition foresaw the advent of grid computing in the early 1990's, analogous to connecting the nation through an electric power grid. With advances in technology – speed, capability, and reduced cost – the ability to distribute computational power has become reality.

One of the first companies to embrace the cloud was Salesforce.com, which developed an application for delivering sales and customer relationship management (CRM) services via the Internet. (Biswas, 2011) Others followed suite with Amazon Web Service (2002), Google Docs (2006), and Amazon's Elastic Compute Cloud (EC2). In 2007 Google and IBM partnered with higher education to introduce cloud computing to academia. (Lombardi, 2007). Finally, Microsoft entered the arena with the introduction of Windows Azure in November 2009.

Adaptation to the cloud will continue to evolve and grow in 2011 and beyond as businesses and academic institutions look to leverage their IT dollars and do more with less. One only has to look at the aforementioned initiatives by Amazon, Google, and Microsoft to realize the advent of cloud computing is here.

The cloud model composed of five essential characteristics

Essential Characteristics:

On-demand self-service: A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service's provider.

Broad network access: Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, laptops, and personal digital assistants (PDAs)).

Resource pooling: The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the subscriber generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or datacenter). Examples of resources include storage, processing, memory, network bandwidth, and virtual machines.

Rapid elasticity: Capabilities can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out and rapidly released to quickly scale in. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be purchased in any quantity at any time.

Measured Service: Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported providing transparency for both the provider and consumer of the utilized service.

Service Models:

Cloud Software as a Service (SaaS): The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through a thin client interface such as a Web browser (e.g., Web-based email). The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.

Cloud Platform as a Service (PaaS): The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or -acquired applications created using programming languages and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly application hosting environment configurations.

Cloud Infrastructure as a Service (IaaS). The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, deployed applications, and possibly limited control of select networking components (e.g., host firewalls).

Deployment Models:

Private cloud: The cloud infrastructure is operated solely for an organization. It may be managed by the organization or a third party and may exist on premise or off premise.

Community cloud: The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be managed by the organizations or a third party and may exist on premise or off premise.

Public cloud: The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services.

Hybrid cloud: The cloud infrastructure is a composition of two or more clouds (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load-balancing between clouds).

ECG Analysis in the cloud

The overall functionality of an ECG monitoring and analysis system involves the following steps:

1. A patient is equipped with a wireless ECG sensor attached to their body and a mobile device that is capable of communicating to the Internet;

2. The wireless ECG sensor module collects patient's data and forwards it the mobile device via Bluetooth without user intervention;

3. A client software in the mobile device transmits the data to the ECG analysis Web Service, which is hosted by a Cloud computing-based software stack. This communication can happen with a home wireless gateway or directly via the mobile's data connectivity (e.g. mobile 3G network);

4. The analysis software carries out numerous computations over the received data taking the reference from the existing demographic data, and the patient's historic data. Computations concern comparison, classification, and systematic diagnosis of heartbeats, which can be time-consuming when done for long time periods for large number of users;

5. The software then appends the latest results to the patient's historic record maintained in private and secure Cloud-based storage, so that authenticated users can access it anytime from anywhere. Physicians will later interpret the features extracted from the ECG waveform and decide whether the heartbeat belongs to the normal (healthy) sinus rhythm or to an appropriate class of arrhythmia;

6. The diagnosis results are disseminated to the patient's mobile device and/or monitor, their doctor and/or emergency services at predefined intervals;

7. The monitoring and computing processes are repeated according to user's preference, which may be hourly or daily over a long period of time.

10.1.1 Healthcare: ECG Analysis in the Cloud Healthcare is a domain in which computer technology has found several and diverse applications: from supporting the business functions to assisting scientists in developing solutions to cure diseases. An important application is the use of cloud technologies to support doctors in providing more effective diagnostic processes. In particular, here we discuss electrocardiogram (ECG) data analysis on the cloud [160]. The capillary development of Internet connectivity and its accessibility from any device at any time has made cloud technologies an attractive option for developing health-monitoring systems. ECG data analysis and monitoring constitute a case that naturally fits into this scenario. ECG is the electrical manifestation of the contractile activity of the heart's myocardium. This activity produces a specific waveform that is repeated over time and that represents the heartbeat. The analysis of the shape of the ECG waveform is used to identify arrhythmias and is the most common way to detect heart disease. Cloud computing technologies allow the remote monitoring of a patient's heartbeat data, data analysis in minimal time, and the notification of first-aid personnel and doctors should these data reveal potentially dangerous conditions. This way a patient at risk can be constantly monitored without going to a hospital for ECG analysis. At the same time, doctors and first-aid personnel can instantly be notified of cases that require their attention. An illustration of the infrastructure and model for supporting remote ECG monitoring is shown in Figure 10.1. Wearable computing devices equipped with ECG sensors constantly monitor the patient's heartbeat. Such information is transmitted to the patient's mobile device, which will eventually forward it to the cloud-hosted Web service for analysis. The Web service forms the front-end of a platform that is entirely hosted in the cloud and that leverages the three layers of the cloud computing stack: SaaS, PaaS, and IaaS. The Web service constitute the SaaS application that will store ECG data in the Amazon S3 service and issue a processing request to the scalable cloud platform. The runtime platform is composed of a dynamically sizable number of instances running the workflow engine and Aneka. The number of workflow engine instances is controlled according to the number of requests in the queue of each instance, while Aneka controls the number of EC2 instances used to execute the single tasks defined by the workflow engine for a single ECG processing job. Each of these jobs consists of a set of operations involving the extraction of the waveform from the heartbeat data and the comparison of the waveform with a reference waveform to detect anomalies. If anomalies are found, doctors and first-aid personnel can be notified of cases that require their attention. An illustration of the infrastructure and model for supporting remote ECG monitoring is shown in Figure 10.1. Wearable computing devices equipped with ECG sensors constantly monitor the patient's heartbeat. Such information is transmitted to the patient's mobile device, which will eventually forward it to the cloud-hosted Web service for analysis. The Web service forms the front-end of a platform that is entirely hosted in the cloud and that leverages the three layers of the cloud computing stack: SaaS, PaaS, and laaS. The Web service constitute the SaaS application that will store ECG data in the Amazon 53 service and issue a processing request to the scalable cloud platform. The runtime platform is composed of a dynamically sizable number of instances running the workflow engine and Aneka. The number of workflow engine instances is controlled according to the number of requests in the queue of each instance, while Aneka controls the number of EC2 instances used to execute the single tasks defined by the workflow engine for a single ECG processing job. Each of these jobs consists of a set of operations involving the extraction of the waveform from the heartbeat data and the comparison of the waveform v, ith a reference waveform to detect anomalies. If anomalies are found, doctors and first-aid personnel can be notified to act on a specific patient.

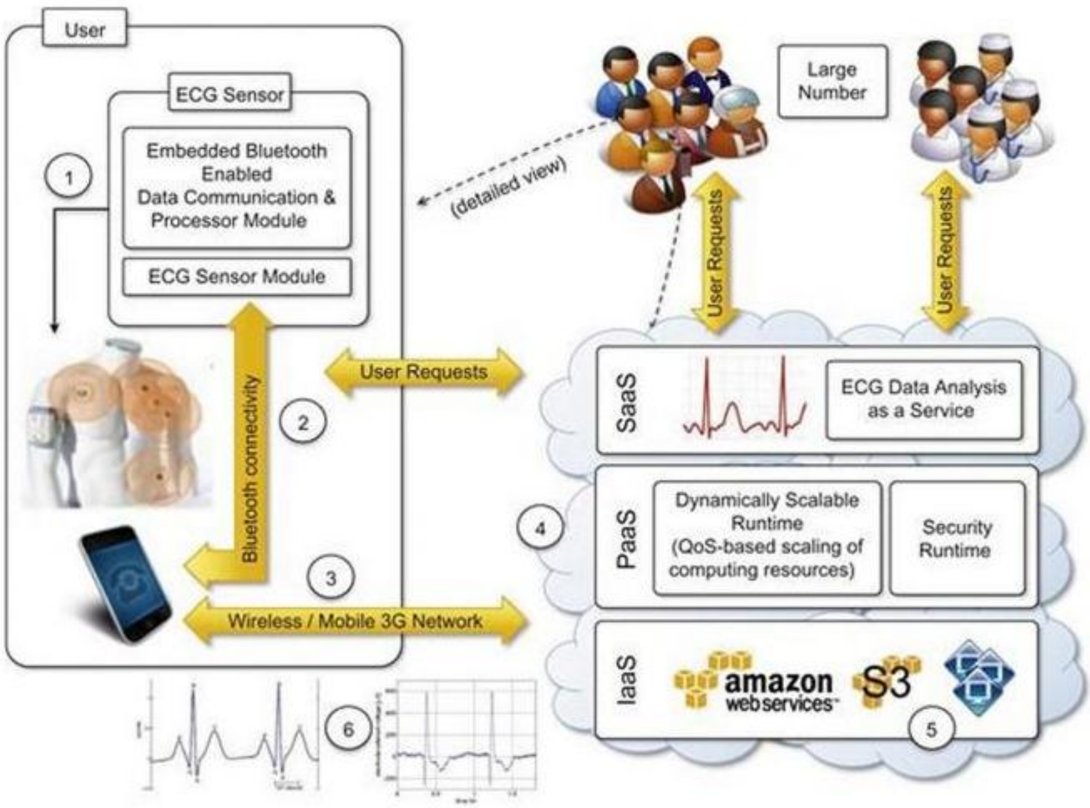

FIGURE 10.1 An online health monitoring system hosted in the cloud.

Even though remote ECG monitoring does not necessarily require cloud technologies, cloud computing introduces opportunities that would be otherwise hardly achievable.

The first advantage is the elasticity of the cloud infrastructure that can grow and shrink according to the requests served. As a result, doctors and hospitals do not have to invest in large computing infrastructures designed after capacity planning, thus making more effective use of budgets. The second advantage is ubiquity. Cloud computing technologies have now become easily accessible and promise to deliver systems with minimum or no downtime. Computing systems hosted in the cloud are accessible from any Internet device through simple interfaces (such as SOAP and REST-based Web services). This makes these systems not only ubiquitous, but they can also be easily integrated with other systems maintained on the hospital's premises. Finally, cost savings constitute another reason for the use of cloud technology in healthcare. Cloud services are priced on a pay-per-use basis and with volume prices for large numbers of service requests. These two models provide a set of flexible options that can be used to price the service, thus actually charging costs based on effective use rather than capital costs.

10.1.2 Biology: Protein Structure Prediction Applications in biology often require high computing capabilities and often operate on large datasets that cause extensive I/O operations. Because of these requirements, biology applications have often made extensive use of supercomputing and cluster computing infrastructures. Similar capabilities can be leveraged on demand using cloud computing technologies in a more dynamic fashion, thus opening new opportunities for bioinformatics applications. Protein structure prediction is a computationally intensive task that is fundamental to different types of research in the life sciences. Among these is the design of new drugs for the treatment of diseases. The geometric structure of a protein cannot be directly inferred from the sequence of genes that compose its structure, but it is the result of complex computations aimed at identifying the structure that minimizes the required energy. This task requires the investigation of a space with a massive number of states, consequently creating a large number of computations for each of these states. The computational power required for protein structure prediction can now be acquired on demand, without owning a cluster or navigating the bureaucracy to get access to parallel and distributed computing facilities. Cloud computing grants access to such capacity on a pay-per-use basis. One project that investigates the use of cloud technologies for protein structure prediction is Jeeva [161]—an integrated Web portal that enables scientists to offload the prediction task to a computing cloud based on Aneka (see Figure 10.2). The prediction task uses machine learning techniques (support vector machines) for determining the secondary structure of proteins. These techniques translate the problem into one of pattern recognition, where a sequence has to be classified into one of three possible classes (E, H, and C). A popular implementation based on support vector machines divides the pattern recognition problem into three phases: initialization, classification, and a final phase. Even though these three phases have to be executed in sequence, it is possible to take advantage of parallel execution in the classification phase, where multiple classifiers are executed concurrently. This creates the opportunity to sensibly reduce the computational time of the prediction. The prediction algorithm is then translated into a task graph that is submitted to Aneka. Once the task is completed, the middleware makes the results available for visualization through the portal.

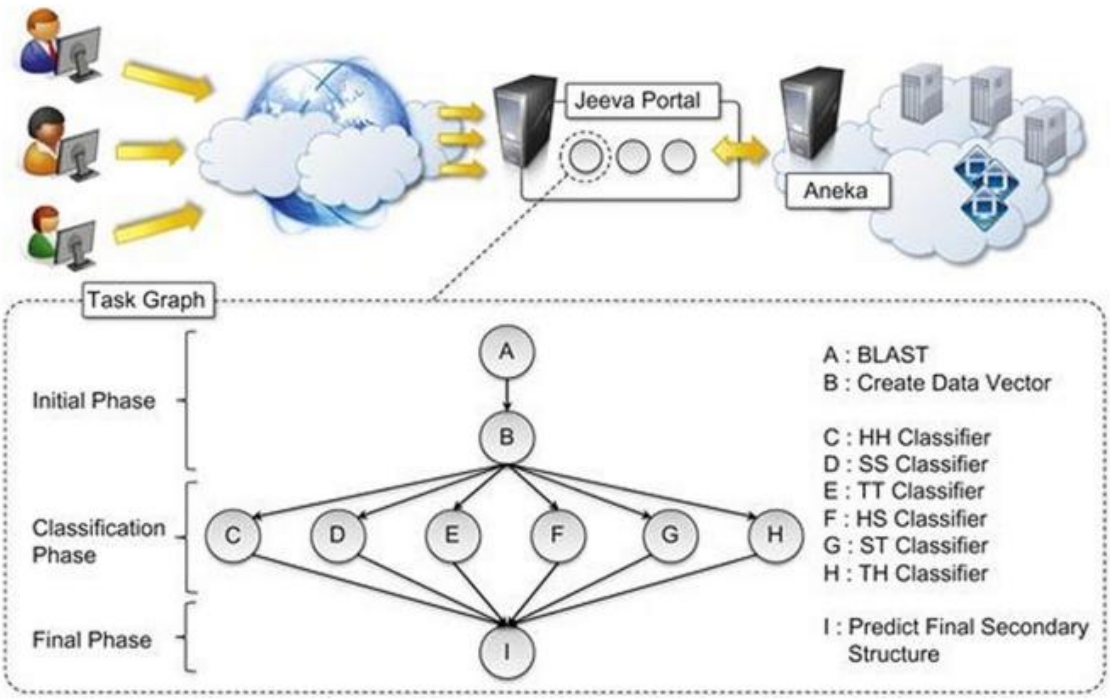

FIGURE 10.2 Architecture and overview of the Jeeva Portal.

FIGURE 10.2 Architecture and overview of the Jeeva Portal.

The advantage of using cloud technologies (i.e., Aneka as scalable cloud middleware) versus conventional grid infrastructures is the capability to leverage a scalable computing infrastructure that can be grown and shrunk on demand. This concept is distinctive of cloud technologies and constitutes a strategic advantage when applications are offered and delivered as a service.

10.1.3 Biology: Gene Expression Data Analysis For Cancer Diagnosis Gene expression profiling is the measurement of the expression levels of thousands of genes at once. It is used to understand the biological processes that are triggered by medical treatment at a cellular level. Together with protein structure prediction, this activity is a fundamental component of drug design, since it allows scientists to identify the effects of a specific treatment. Another important application of gene expression profiling is cancer diagnosis and treatment. Cancer is a disease characterized by uncontrolled cell growth and proliferation. this behavior occurs because genes regulating the cell growth mutate. This means that all the cancerous cells contain mutated genes. In this context, gene expression profiling is utilized to provide a more accurate classification of tumors. The classification of gene expression data samples into distinct classes is a challenging task. The dimensionality of typical gene expression datasets ranges

X

X

X

X

X

X

Geoscience applications collect, produce, and analyze massive amounts of geospatial and nonspatial data. As the technology progresses and our planet becomes more instrumented (i.e., through the deployment of sensors and satellites for monitoring), the volume of data that needs to be processed increases significantly. In particular, the geographic information system (GIS) is a major element of geoscience applications. GIS applications capture, store, manipulate, analyze, manage, and present all types of geographically referenced data. This type of information is now becoming increasingly relevant to a wide variety of application domains: from advanced farming to civil security and natural resources management. As a result, a considerable amount of geo-referenced data is ingested into computer systems for further processing and analysis. Cloud computing is an attractive option for executing these demanding tasks and extracting meaningful information to support decision makers. Satellite remote sensing generates hundreds of gigabytes of raw images that need to be further processed to become the basis of several different GIS products. This process requires both I/O and compute-intensive tasks. Large images need to be moved from a ground station's local storage to compute facilities, where several transformations and corrections are applied. Cloud computing provides the appropriate infrastructure to support such application scenarios. A cloud-based implementation of such a workflow has been developed by the Department of Space, Government of India [163). The system shown in Figure 10.4 integrates several technologies across the entire computing stack. A SaaS application provides a collection of services for such tasks as geocode generation and data visualization. At the PaaS level, Aneka controls the importing of data into the virtualized infrastructure and the execution of image-processing tasks that produce the desired outcome from raw satellite images. The platform leverages a Xen private cloud and the Aneka technology to dynamically provision the required resources (i.e., grow or shrink) on demand.

CRM

Abstract. Social **CRM** is critical in utilities services provided by cloud computing. These services rely on virtual customer communities forming spontaneously and evolving continuously. Thus clarifying the explicit boundaries of these communities is quite essential to the quality of utilities services in cloud computing. Communities with overlapping feature or projecting vertexes are usually typical irregular communities. Traditional community identification algorithms are limited in discovering irregular topological structures from a CR networks. These uneven shapes usually play a prominent role in finding prominent customer which is usually ignored in social CRM. A novel method of discovering irregular community based on density threshold and similarity degree. It finds and merges primitive maximal cliques from the first. Irregular features of overlapping and prominent sparse vertex are further considered. An empirical case and a method comparison test indicates its efficiency and feasibility

Keywords: Cloud computing: Irregular community discovery: Social CRM.

1 Introduction

The distinctive traits of cloud computing are its efforts on providing value-added trustee services, maximizing flexible integration of computing resource, as well as advancing cost-saving IT service. To provide value-added trustee services, the "cloud" should be capable of identifying the customer relationship communities and answering for users' innovation strategy. To maximize flexible integration of computing resource, the "clouds' should in both human computing resources and electronic computing resources. Many computing tasks are usually more suitable for human to process than for electronic computing machines. Integrating the Human computing ability or crowd computing ability into the "cloud" can enhance its processing capabilities with the help of vast human brains dispersed on the Internet. This means that the "cloud" should be competent for tracking customer information and understanding the interaction way of its users. Accordingly, customer relationship management CRM is critical in utilities services provided by cloud computing. Fig I illustrates that social CRM plays an important role in supporting value-added trustee service and exploiting human computing resources in cloud computing. CRM involves in attracting new profitable customers and forming

Fig. 1. Social CRM as an important components in cloud computing

tighter bonds with existing ones. Since online social communities and conversations carry heavy consequences for companies, social CRM integrates social network into the traditional CRM capabilities. Information gained through social CRM initiatives can support the development of marketing strategy by developing the organization's knowledge in areas such as identifying customer relationship community. improving customer retention, improving product offerings by better under-standing customer needs. Customer relationship network as a kind of social network, with CR network for short, uses a vertex for a customer and a link for the relationship between two vertexes. Many online cloud computing services rely on virtual communities that spontaneously emerge and continuously evolve. Thus clarifying the explicit boundaries of these communities is quite essential to ensure service qualification. Communities with overlapping feature or projecting vertexes are usually typical irregular communities. Traditional community identification algorithms are limited in discovering irregular topological CR network that is very important in CRM. With an uneven shape. these communities usually play a prominent role in finding prominent customer which is usually ignored in social CRM. For this reason, this paper proposes a novel approach of irregular community identification based on density threshold and similarity degree. With a polymerization approach, maximal complete cliques in a CR network are identified from the beginning. These primitives are further assembled into larger combinations. For overlapping cases, processes of merging these combinations or repartitioning them are executed according to corresponding rules. And communities with prominent parts are also considered in irregular identification.

ERP

Cloud computing is a service that offers reliable IT infrastructure and software services off the user premises thereby saving cost on hardware, software, power and labour. Cloud computing enables organization to reduce total cost of ownership on IT infrastructure, it is a new paradigm shift that includes, computing resource services, soft applications of distributed systems and data storage. Thus, the computing world is quickly transforming toward a system of deriving relative applications for millions to extend as a service rather than to run on their personal computers (Low and Chen, 2011).

The term Enterprise Resource Planning (ERP) system dates from 1990 when Gartner used it for the first time. ERP is a cross-functional information system, considered as process oriented and legacy system, because it integrates management information across the entire enterprise and serves the information needs of the entire enterprise (Lenart, 2011). The ERP system is the backbone of information systems in an enterprise or financial and government institution and is referred to as “the set of activities that managers use to run the important parts of an organization such as purchasing, human resources, accounting, productions and sales” (Bradford, 2010).

The ERP system can be deployed in three forms, on-premise, hosted and on the cloud. Cloud computing has influenced a new way of thinking about ERP software deployments. Companies have the option to purchase ERP license or purchase a cloud-hosted solution. When you acquire a license, you own the software and have the rights to deploy it in your data centre (on-premise) or outsource operations to an external provider (hosting). When you purchase a SaaS (software as a service) solution, you rent a complete turnkey package that includes software and the entire delivery mechanism (Johnson, 2011).

On the other hand, there are many obstacles involved in cloud hosted ERP such as security risks, CSP might declare bankruptcy or might fail to deliver according to service level agreement (SLA) (Saeed et al, 2011). Olson (2007) also elaborates on previous studies and states the following reasons against cloud ERP “The security and privacy risks, vendor dependency and lock-in risks, concerns about availability, performance, reliability and high migration costs" He argued further that ERP users become totally dependent on CSP whose ERP expertise and competency are critical to client's success. It becomes difficult for the users to outsource ERP if the systems are completely tied to the IT infrastructure, or the in-house applications are critical for business. Moreover, if an organization's IT department is currently as efficient as the ASP's, then there is no benefit in outsourcing the ERP systems.

One may wonder how cloud computing will work and what could be the impact on medium size firms. A company might require an information system that will allow them perform accounts payable, accounts receivable, inventory management, supplier logistics, sales order processing, e-commerce and customer relationship management activities. By making use of cloud hosted infrastructure, the component relevant to their business may be brought to them on a pay-and-go basis without the need to purchase an entire ERP, finance or CRM suites and the hardware to host such enterprise application (Sharif, 2010).

Justifying cloud hosted ERP over an on-premise deployment is not a bad idea. If you are short of spare IT infrastructure, servers, OS licenses, and database licenses, the cost of hiring an expert should also be considered because it can be too high. In addition, even if you justify the cost, it is probably not worth the hassle of developing internal expertise or taking on the responsibility of providing (24×7) operations (Johnson, 2011). Other factors that are important in choosing an ERP deployment scenario are company size, compliance with law and security risk (Lenart, 2011).

Cloud Hosted ERP presents opportunity to transform how an organization and its people work if properly deployed and built around the people, not the other way round. One of the opportunity is reduced Total Cost of Ownership (TCO).

A repetitive advantage for Cloud ERP is a faster implementation and deployment.

Social Networking

Where Social Networking Fits with Cloud Computing Opinions on social networking vary widely, from "No way, it's too risky" to "It's a way of life; you might as well learn to leverage it for productivity." Social networking has already been lumped in with cloud computing. so it is a good idea to consider its value and risks. How will you integrate social networking within your SOA using cloud computing architecture? Now is a good time to form a set of policies.

It does not matter whether you understand the differences between MySpace and Facebook. Most of the people who work in your enterprises, IT or not, leverage some sort of social networking system, and most look at it at least once a day during work hours. Assuming you could put your foot down and declare this stuff against policy, most employees would find that a bit too Big Brother—ish and would find a way to do it anyway, perhaps on their cell phones or PDAs. Social networking in the workplace is a fact of life you must deal with, and perhaps it could be another point of value that comes down from the clouds. To figure out the enterprise opportunities or risks involved with social networking, you first must define the reasons that people leverage social networking: • To communicate, both passively and actively, in an ongoing manner and through various mediums, with people in whom they are interested—usually with friends and family, but in some cases, the activity is all work related. Typically, it's a mixture of both. • To learn more about areas of interest. For example, LinkedIn groups, such as SOA, Web 2.0, and enterprise architecture.

• To leverage social networking within the context of the SOA using cloud computing architecture, such as allowing core enterprise systems, on-premise or cloud-based, to exchange information. For instance, social networking can be used to view a customer's Facebook friends list to find new leads, and thus new business opportunities, by integrating Facebook with your sales force management system. There are risks involved in online social networking, however. People can (and do) lose their jobs because of a posting on a social networking site that put their company at risk. People can be (and have been) publically embarrassed by posting pictures, videos, or other information they thought would be, uhm, private. Also, there are many cases of criminal activity using social networking as a mechanism to commit a crime. Here is the gist of it. Social networking, in one form or another is always going to be around. So if you are doing enterprise IT, including cloud computing, you might as well accept it but learn how to govern through education, policies, and perhaps some technology. While there are risks, there are also opportunities, such as the ability to leverage information gathered by social

UNIT II

Interoperability is the ability to intemperate between two or more environments. This includes operating between on-premises data centers and public clouds, between public clouds from different vendors, and between a private cloud and an external public cloud. For example, from a tooling or management perspective, with the right broadly stabled standards, one would expect that the application programming interfaces (APIs), the tools used to deploy or manage in the cloud, would be used by multiple providers. This would allow the same tool to be used in multiple cloud environments or in hybrid cloud situations.

Interoperability is especially important in a hybrid environment because your resources must work well with your cloud providers' resources. To reach the goal of interoperability, interfaces are required. In some instances, cloud providers will develop an API that describes how your resources communicate with their resources. APIs may sound like a good solution, but problems can arise. If every cloud provider develops an API. you run into the problem of API mlifemtion. a situation where there are so many APIs that organizations have difficulty managing and using them all. Having so many APIs can lead to vendor lock-in, which means that once you start using a particular vendor, you're committed to them. All of this can also lead to portability issues.

Different approaches have been proposed for cloud interoperability. For example, some groups have proposed a cloud broker model. In this approach, a common unified interface, called a broker is used for all interactions among cloud elements (for example, platforms, systems, networks, applications and data).

Alternatively, companies such as CSC and RightScale have proposed an orchestration model. In this model, a single management platform is provided that coordinates (or orchestrates) connections among cloud providers. Recently NIST documented the concept of functional and management inter-faces when discussing interoperability. The interface presented to the functional contents of the cloud is the functional interface. The management interface is the interface used to manage a cloud service. Your management strategy will vary depending on the kind of delivery model utilized (for more on delivery models, see Chapter I).

Another player in the interoperability space is the Open Services for Iifecycle Collaboration (OSLC). The OSLC is working on the specifications for linked data to be used to federate information and capabilities across cloud services and systems.

NIST has also cataloged existing standards. According to NIST, many existing IT standards can help to contribute to the interoperability among cloud consumer applications and cloud services, and among cloud services them-selves. However, only the following two interoperability standards are developed and accepted specifically for the cloud (although others are currently under development and are likely to emerge quite soon):

• Open Cloud Computing Interface (OCCD: A set of standards developed by the Open Grid Forum. OCCI is a protocol and API for all kinds of management tasks and utilizes the REST (Representational State Transfer) approach for interaction. It began its life as a management API for laaS services. It now supports PaaS and SaaS deployments. V The

• The Cloud Data Management Interface (CDMD: Developed by the Storage Networking Industry Association (SNIA). It defines the functional interface that applications should use to create, retrieve, update, and delete data elements from the cloud. It also utilizes a Restful approach.

Some standards currently under development include the Institute of Electrical and Electronics Engineers (IEEE) IEEE P2301, Draft Guide for Cloud Portability and Interoperability Profiles (CPIP); and the IEEE P2302, Draft Standard for Inter cloud Interoperability and Federation (SIIF).

CLOUD ECOSYSTEM

"Today, cloud Computing has matured operationally to delivery the strategically and tactical value expected. Companies not willing to learn from the hyper-cycle history will not reap the benefits and will eventually struggle to thrive and survive. On the other hand, companies that are able to adopt and innovate their business model will create and deliver value in new ways. Thrive and gain a competitive advantage." I lenrik von Scheel. Director at NI 0 7EVEN and ethority rimbl I "For those tasked with engaging cloud services. they will recognize that the value of the service. But soon the shift in thinking will be around the cloud ecosystem. Here is my definition of a cloud ecosystem: "A Cloud Ecosystem is the organisation of cloud service to facilitate the execution of business processes. Service-level agreements for those relationships will be oriented around the process and not the individual services. In turn. Enterprise operations can be mapped and executed with quality standards within the ecosystems. "This evolution of thinking will denthnd more from the cloud providers. In the end only a few cloud ecosystem providers will prevail. Companies like Salesforce. SAP. and NetSuite have already made great headway to become Cloud Ecosystem providers. "The importance of this move will have a profound effect on the industry and for businesses in general. All other cloud providers will have to find a way to participate with Cloud Ecosystem provider's environments." IT Executive and consultant.

One factor in the successful adoption of cloud will be that of geography. When asked. Jie Song, Associate Professor at the Software College, Northeastern University, in China observed: "The network speed is important for cloud computing user experience. But the network speed in China is very slow, so something must be done in the next few years to improve the speed, or it will become a big obstacle. Standardisation is a key factor in the development of cloud computing. A standard unified interface for different vendors' access provided by cloud platform is needed. Cloud is just started to develop in China, and is getting more and more attention. In universities and large corporations. cloud is a hot topic now."