An Approach through Private Cloud using Gemfire Database

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ABSTRACT

With Cloud computing, more complex and mission critical applications are moving to the Cloud so transactional, secure, reliable and highly available databases are a requirement for many Cloud applications. Corporate computing will inevitably become much more distributed than spreading itself across multiple data centers. This will acquire management, architectural and performance challenges - and foster innovation to meet those challenges. GemFire Enterprise is a distributed memory oriented data management platform that pools memory (and CPU, network and optionally local disk) across multiple processes to manage application objects and behavior. GemFire uses dynamic reproduction and data partitioning techniques to offer continuous accessibility, high performance and linear scalability for data intensive applications without compromising on data consistency even when exposed to loser conditions. Besides being a distributed data container, it is an active data management system that uses an optimized low latency distribution layer for reliable asynchronous event notifications along with highly concurrent data structures for storage.

This paper looks at what cloud computing and cloud database is. An online system is built as B2C application which has its data stored in CLOUD database GEMFIRE. It's then deployed in eyeOS of a desktop forming a private cloud.

Keywords: Private cloud, Gemfire, B2c,Cloud computing

1. INTRODUCTION

Cloud computing has had many definitions over the years but the most common understanding is that it is Internet computing whereby shared servers render resources, software and data to computers and other devices on demand. The cloud itself is a set of hardware, networks, storage, services and interfaces that enable the delivery of computing as a service. Cloud services hold the delivery of software, substructure and storage over the Internet based on user demand [1].

The underlying concept of cloud computing dates back to the 1960s where an idea of an 'intergalactic computer network' was introduced by J.C.R Licklider, who was responsible for enabling the development of ARPANET (Advanced Research Projects Agency Network) in 1969. Since then, cloud computing has grew along a number of lines [7].

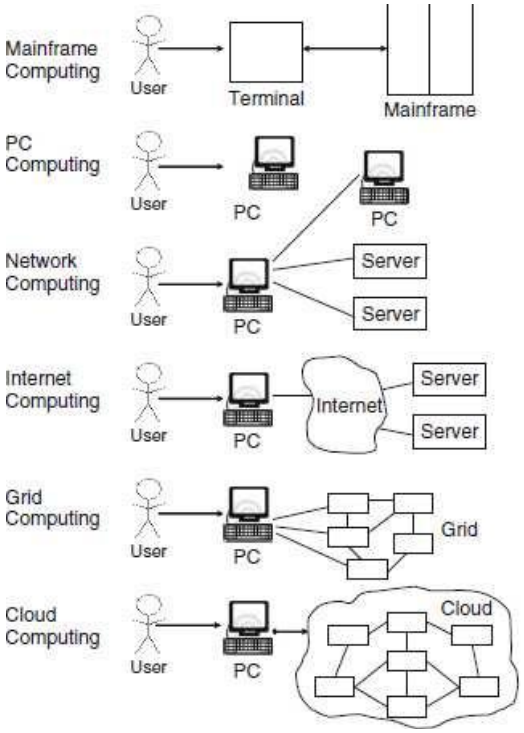
Amazon played a key role in the development of cloud computing by initiating a new product development effort to provide cloud computing to external customers. They launched Amazon Web Services (AWS) on a utility computing basis in July 2002 which set the stage for the launch of Simple Storage Service (S3). In March 2006, Amazon launched the S3 which defined the model of 'Pay-per-use', which is now the standard for cloud pricing [7].

Since then, other companies have joined in the provision of cloud services. The major ones include Amazon, Google, Microsoft, Salesforce, Skytap and Rackspace Cloud. The world of cloud computing has different parties involved:

• The end user who does not really have to know anything about the underlying technology.
• The business management who need to take responsibility for overall governance of data or services living in a cloud.
• The cloud service provider is responsible for IT assets and maintenance [2].

Figure 1 below shows the different types of computing available in the past as well as at present. This comparison of computing gives a clear explanation of what cloud computing really is.

FIGURE 1 – Evolution of Cloud Computing



In mainframe computing, users shared powerful mainframes using dummy terminals. Stand-aloneh Personal Computers became powerful enough to meet the needs of the users thus leading to Personal Computer computing. Personal Computers, laptops and servers were connected through local

networks to share resources and increase performance hereby creating network computing [2].

Internet computing was achieved by the connection of local networks to other local networks forming a global network such as the Internet to utilize remote applications and resources. Grid computing supplied shared computing power and storage through a distributed computing system. Cloud computing hence furnishes shared resources on the Internet in a simple and scalable way. [2]

Mainframe computing and cloud computing might look similar but in reality have various differences. Mainframe computing offers finite computing power while cloud computing offers infinite power and capacity [2]. In mainframe computing, dummy terminals acted as the user interface devices while in cloud computing, powerful PCs provide local computing power and support.

2. BASIC FEATURES OF CLOUD

There are basic features of the cloud:

• Elasticity and scalability means that the service needs to be available all the time and to be designed to scale upward for high periods of demand and downward for lighter ones. The application should be able to value when additional users are added and when the application requirements change.

• Self-service purveying should enable customers to easily get cloud services without going through a lengthy process.

• Application programming interfaces (APIs) need to be standardized for cloud services. These interfaces provide the instructions on how two applications or data sources can communicate with each other. A standardized interface lets the client link a cloud service with ease instead of resorting to custom programming.

• Billing and measuring of services should be a built-in service that bills customers.

• Performance monitoring and management demanded service level for that organization.

• Security is a critical characteristic in a cloud. Turning over critical data or application infrastructure to a cloud service provider requires making sure that the information cannot be compromised

3. CLOUD COMPUTING ARCHITECTURE

Cloud computing can be considered as a collection of services which are presented in a layered architecture, as shown in figure 2.

Cloud application services, also known as 'Software as a Service' deliver services over the Internet, allowing users to remotely access applications from the cloud [1]. They also eliminate the need to install and run the applications from the users' own computers. A good example of application services is Yahoo mail or Gmail whereby all the users require is Internet to access their mail, irrespective of the computer they are using

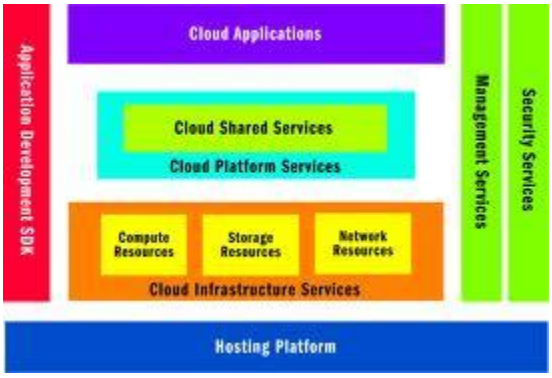


FIGURE 2. Layered architecture of cloud computing.

Cloud platform services, also known as 'Platform as a Service' provide an integrated set of software that supplies everything a developer needs to build an application for both software development and runtime [1]. It facilitates the deployment of applications without the cost and hassle of buying and maintaining the hardware and software layers. Force.com and Google App Engine are good examples of platform services.

'Infrastructure as a Service', is the delivery of computing resources as a service[1]. These resources include virtualized computers with guaranteed processing power and reserved bandwidth for storage and Internet access. Virtualization separates computing functions and technology implementations from the physical hardware [1]. The 'data Storage as a Service' provides storage that the user requires including bandwidth requirements for the storage. Cloud computing is offered in three forms as clearly shown in figure 3 below:

• Public cloud, whereby the computing resources are dynamically provisioned over the Internet via web applications or web services from an off-site third party provider. Here applications from different clients are likely to be mixed together in the cloud's servers, storage system and networks.

• Private cloud, also known as internal cloud refers to cloud computing on private networks. These private clouds are made for a specific client thus providing full control over data, security and quality of service. A private cloud can be built and managed by a company's own IT organization or by a cloud provider.

• Hybrid cloud, combines multiple public and private cloud models. They introduce the complexity of determining how to distribute applications across both public and private clouds [2].

4. PROCESS INVOLVED IN CLOUD COMPUTING

When a user accesses content in the cloud by making web service requests, the cloud goes through a couple of steps to service the request:

• Accepts the request
• Recognizes that user has permission rights to make the request
• Formalizes the request against account limits
• Looks for suitable resources

• Binds the resources to the user's account
• Initializes the resources
• Yields identifiers for the resources to satisfy the request [6]

Once these steps are completed, the user application then has exclusive access to the resources for as long as required. After the user is done and the application does not need the resources, the application is responsible for returning them to the cloud. Here they are prepared for reuse by being reformatted, erased or rebooted and then marked as free [6].

5.EYE OS CLOUD SYSTEM

eyeOS is free Cloud Computing Operating System software which let you access all your necessary files, folders, office, calendar, contacts and much more anywhere in the world. You can use it personally on your computer or you can use it for collaborative work and share data to your company, firm, customers and colleagues for more new ideas and better group action. You can host eyeOS on your server and build your own Cloud system to access your data anywhere you want to.
eyeOS is released under the AGPLv3 license and only needs Apache 2 server, PHP5 and MySQL database server to run. With eyeOS you can build your private Cloud Desktop today. If you don't have webhosting or Webserver anywhere then you can create free account on eyeOS free public server and start your own cloud right away and yeah it's Free.

Moreover, eyeOS 2.0 now comes with Live Collaboration engine which allows you to work collaboratively with other users simultaneously in the same document, thanks to the new Social Bar. It also has a powerful applications bundle that includes 5 powerful applications out of the box thought to be simple and easy to use: Word Processor, Calendar, Mail Client, Spreadsheets and Files Manager. However, the most crucial element of eyeOS is the built-in cloud privacy - eyeOS is the Safe Cloud Computing system because you can host it in your own Laptop, Desktop, company or organization. Privacy is predominant especially in cloud computing where there has been no research to back it. However, with eyeOS strong trust in privacy in cloud computing – the onus remains on how best you implement IT security best practices in your organization network infrastructure.

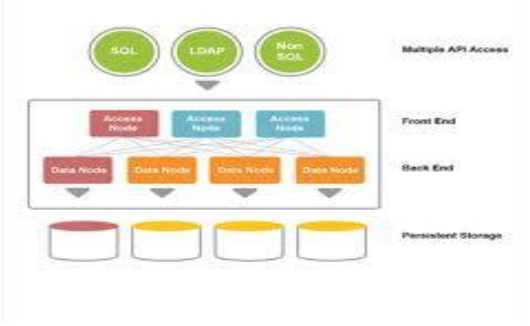
In education sector – eyeOS cloud is an excellent tool that can easily be implemented in education environment to complement eLearning tools like Moodle LMS. The eyeOS group has surpassed in delivering the design, implementation and maintenance of this desktop cloud solution that is capable of bringing enhancements in acquiring delivering, flexibility and security while reducing the complexity and investment costs associated with current IT solutions – since in any case it's open source – free to use. For example, a department can install eyeOS to all its Desktop and laptop computers and then integrate all the activities, syllabus, lab materials. Courses can be implemented as group activities and students can be enrolled into such groups. When implemented suitably, eyeOS cloud has the potentiality and tractability to provide the platform for testing the solution and knowledge about IT integration in the classroom.

When fully implemented, students will have access to education materials to follow the courses and create their own content. By using the eyeOS Desktop Cloud, they can also get together with other students using social networks, communities and web/video conferences. By using this result, teachers will be able to completely focus on course content and rather than addressing and solving IT issues. Education partners' achromatic, parents, protectors or relations will be able to support the students with their education since the virtual classroom can be accessed from any device with Internet access. In general, broadcasting eyeOS cloud in learning environment is bold initiative that is definitely bound to promote technological innovation that is expected to revolutionize the way education is delivered in the future leading to better learning outcome and experiential learning environment for students.
Today building your own private hosting solution have never been so easy – especially with the current advances in open source technologies. For example, you can use DTC GPL Control Panel to build your own private ISP hosting solutions. Domain Technologie Control (DTC) is a web-based control panel aimed at providing a graphics-oriented layout for managing commercial and private hosting of web servers, specified for shared web hosting servers, virtual private servers (VPSes), and dedicated servers. Domain Technologie Control is free software released under the GNU LGPL v2.1 license.

6. What is Cloud Database [8]

We can define a cloud dbms (CDBMS) as a distributed database that delivers a query service across multiple distributed database nodes located in multiple geographically-distributed data centers, both collective data centers and cloud data centers. So think in terms of an system with some applications running in the cloud. Perhaps Salesforce.com plus some hosted transactional web applications in some remote data center plus local applications including BI applications split between two data centers. Such a situation is instanced in Figure 3. It is the typical situation that companies will have to deal with as we move forward. In recitation, a query can originate from anywhere; from a PC within the corp, which is connected by a fast line to the local data center, from a Personal Computer in the home via a VPN line, from a laptop via a WiFi connection, or from a smart phone via a 3G or 4G connection. For that reason we comprise a query here as coming "through the Internet" implying that the response will possibly travel through the Internet too.

FIGURE3. CLOUD Database Concept

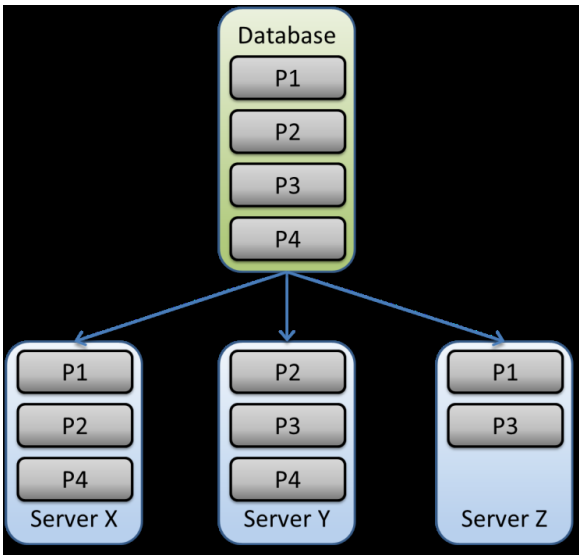


The CDBMS will not concentrate all query traffic through a single node. A peer-to-peer architecture will be far more scalable - with any single node able to receive any query. In such an arrangement, each node needs to have a map of the data stored at every node and know the performance characteristics of every node. When a node gets a query its first task is to determine which node is best able to respond to the query. It then gives responsibility for the query to that node. That node performs the query and returns the result directly to the user. Figure 3 shows more than one CDBMS node in some of the data centers. In practice, it will likely be

necessary to configure more than one node per data center to distribute the database workload within the data center as well as between data centers.

Consider Figure 4. It illustrates the likely strategy that would be used by a CDBMS node in accessing data contained in local transactional databases or files. If the data is contained in a database, the CDBMS can either get at the data directly (via ODBC, for example) or access a duplicated data store. Replication will only be needed if read access to the data imposes too great an impact on performance. Critical systems often have a hot standby in place ready to go if the primary system fails, in which case the stand-by systems database could be used as a data source. Data might also be drawn from functional data stores or data warehouses, with the same kind of duplication strategy being employed.

FIGURE4. Database Partitioning and Replica



7.GEMFIRE Database[9]

GemFire Enterprise is a high-performance, distributed operational data management infrastructure that sits between your clustered application processes and back-end data sources to provide very low-latency, useable,high-throughput data sharing and event distribution. GemFire harnesses the memory and disk resources across a network to form a real-time data fabric or grid. By mainly managing data in memory, GemFire enables highly high-speed data sharing that turns anetwork of machines into a single logical data management unit – a data fabric. GemFire is used for managing operational data – Unlike a traditional centralized disk-based database management system used for managing very large quantities of data, GemFire is a real-time data sharing facility specifically optimized for working with operational data needed by real-time applications – it is the "now" data, the fast-moving data shared across many processes and applications. It is a layer of generalization in the middle tier that collocates frequently-used data with the application and works with back-end databases behind the scenes.

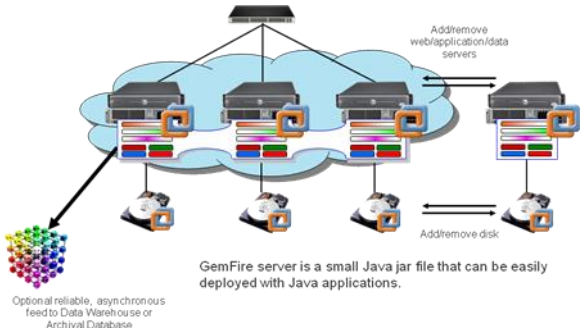


FIGURE 5 - GEMFIRE Database

8.EXISTING SYSTEM

The development of grid computing and cloud computing, finite computing resources supplied by standalone server usually becomes the bottleneck in the process of system implementation of online trading platform. Moreover, it is difficult to reuse algorithm module and the system also becomes more fine-tuned to achieve. Traditional online trading framework cannot preferably solve the problem listed above.

The enterprise clients have to buy their own servers, install them and maintain them at their own cost. They have to build their own applications, buy software licenses and spend huge money for maintaining and supporting these applications. Inspite of this investment, enterprise applications face performance bottlenecks, inefficient usage of their resources like memory, CPU, etc. On the other side, buying computers for everyone isn't enough, they also have to purchase software or software licenses to give employees the tools they require. Whenever they have a new hire, they have to buy more software or make sure their current software license allows another user. It's so stressful that they find it difficult to go to sleep on your huge pile of money every night.

9.PROPOSED SOLUTION

We propose an online trading platform based on cloud computing, which possesses not only high flexibility, high reliability, low-level transparency, security features in cloud computing [3]. Personal cloud computing means having every piece of data you need for every aspect of your life at your fingertips and ready for use. Data must be mobile, transferable, and directly accessible. The objective of this project is,

• To develop MVC based B2B web applications for online trading system

• Deploy and run the application in a private CLOUD desktop using Eye OS & XAMPP

• Use GEMFIRE database for storing and retrieving the data

• Host it in Eye OS free public server and access my application via internet.

10. APPLICATION ARCHITECTURE

Following are the modules implemented in online system used in this project:

- Login Module
- Registration Module
- Item Master
- Order Master
- Payment module

FIGURE 6 – Application Architecture

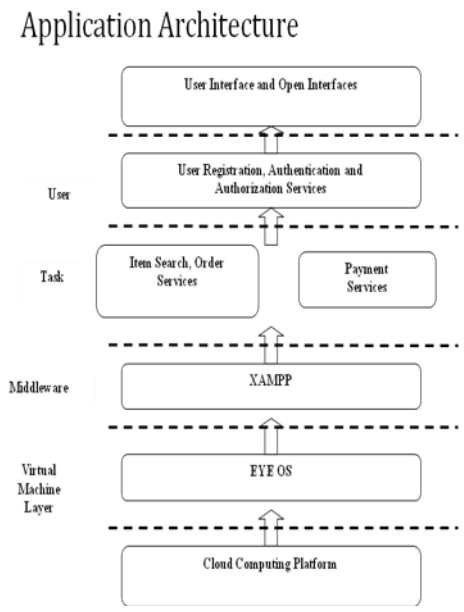
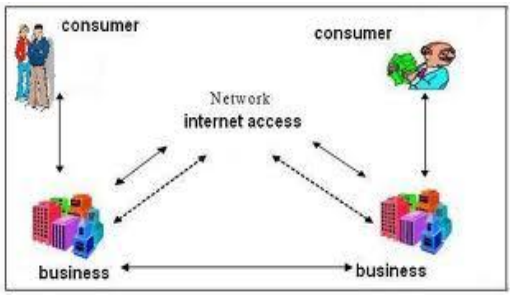


FIGURE 7 – B2B Business Model



11.CONCLUSION

Cloud Computing in a B2B environment offers the means to provision a constantly up-to-date B2B infrastructure at a fraction of the cost that an individual organisation could do themselves. It extends the potential of a range of value-added services that can drive efficiency through all aspects of your B2B operations. B2B Managed Services providers utilise a Service Oriented Architecture (SOA) to quickly and cost-effectively create innovative B2B applications that they can 'rent' on-demand to organisations who are looking to maximise connectivity with their trading partner community. Key benefits of using a B2B cloud are

- No development or maintenance of infrastructure
- The B2B infrastructure is always based on the latest measures and technologies
- No need for direct point-to-point connection with your trading partners
- Marketing partner profiles are maintained externally
- Functioning and support is backed by solid SLAs
- No software license costs
- Only pay for what you use
- Scalable capacity as required

CLOUD database offers an innovative and comprehensive database solution that addresses the challenges of cloud-based data management, emerging technologies and markets. It aims to provide the best solution to all data management aggresses, a solution that is capable of handling and exceeding any requirements of scale or extremely high availability, without flexible functionality, ACID abidance and SQL support.

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