Analysis and Usage: Cloud Computing Technology in the Supply Chain Management

Dr. Syed Abdul Rehman Khan[1, 3], Prof. Dong Qian Li[1], Ms. Zhang Yu[2]

[1.] School of Economics and Management, Chang'an University, Xi'an, 710064, China
[2.] School of Economics and Management, Xi'an University of Technology, Xi'an, 710064, China
[3.] A Member of APCIS, Chicago, IL, US
sarehman_cscp@yahoo.com

Abstract: In the supply chain management, several processes are involved and integrated together to make them efficient and effective. Mainly the products or material move from supplier side to down-stream with the value-addition. Information technology refers to use for the information sharing with partners of supply chain, storing and managing data etc. there is no doubt; due to the usage of latest technology, supply chain become more productive and efficient. Information collaboration systems based on the technology of "cloud computing" offer efficient information system based on cloud computing technologies such as "Platform as service", "software as service" and "infra-structure as service". With the accessibility to use "anywhere and anytime" cloud services offer sharing of resources of its services to supply chain management. Information sharing in the supply chain is demand driven through nature, decrease / increase globally so it's should not require centralize system. This article, adopts the idea of cloud-computing technology to give an effective and efficient solution for supply chain using decentralized data-center of cloud-computing.

1. Introduction

Nowadays companies are finding ways to optimize operational efficiency and also minimize the cost of supply chain, such as sourcing and procurement, planning & forecasting, logistics and service management. We can define Supply chain management as the "Design, Planning, and Execution, Control & monitoring of activities with the aim of maximizing value, leveraging worldwide logistics, competitive infrastructure and measuring performance". The latest developments in the technological world enable companies to use and avail information access in their own premises. As per the (CSCP-APCIS US Book, 2013) technology is the backbone of the supply chain management. Technologies enable firms to share their latest information with their supply chain partners' frequently and also make chain of supply stronger than ever before. The activities of supply chain cover everything from production development or procurement to delivery to customer. In-addition information systems also required to coordinate these all activities.

The technology of Cloud computing emerges as an important and latest technology, which plays a vital role in optimization by providing infrastructure, software solutions and platform for the end-to-end supply chain through internet. In the supply chain, usage of cloud-based services leads to operational and financial advantages. Supply chain visibility, lower cost, platform scalability & flexibility by collaboration of supply chain partners are some prominent examples.

The technology of cloud computing is a term, which involves virtualization, networking, decentralized computing and web-services. This technology of cloud computing may be defined as "a cloud is a kind of distributed/ decentralized system consisting for a collection of virtualized and inter-connected computers that are dynamically presented and provisioned as one or more unified computing resource based over agreements of service-level established by negotiation among the consumers and service provider" (Kumar *et al.,* 2008).

Cloud consists of many elements like data center, decentralized/ distributed servers, and clients. It also includes high availability, flexibility, fault tolerance, scalability, fault tolerance, on demand services and minimize cost of ownership etc. The basic benefits of cloud based systems are their simplification. Cloud also minimize the problem of compatibility using same platform access & gives easy connection to all users of supply chain. Cloud-based allows information of supply chain collaboration among partners in one supply chain system. All supply chain members may enter & added in the collaborative environment of cloud using member id and their passport. After that, users

are authorized to use simple process & application on the same platform; which minimize to the response time of all supply chain partners.

Timely visibility is also a one big advantage of cloud- computing, which helps in timely connectivity along multiple participants of supply chain. Consequently, in the supply chain, visibility is a main and important issue as it not only support and helps such firms to coordinate their operations and manage many customers but it also enable to the network of customers to have a transparent view of the whole system. The system of cloud-based are able to offer in-time visibility of shipments, inventory and also make tracking more improved.

In the cloud computing, organizations can control and trace their capacity of system more accurately than ever before. In the time duration or period when demand is high, firms require well-enough capacity in order to fulfill that higher demand. Therefore, using common systems in premises, they need to own the database (necessary) for the complete year in term to counter and respond to excessive demand only for a short-term. But with the arrival of cloud- computing technology, firms have the opportunity to automatically adjust their capacity as per their requirement & scale, their power of computing depending over fluctuation of demand.

2. History and Future Prospective of SCM in Cloud Computing

Thomas Schramm, Wright, Seng & Jones (2010) divided the era of supply chain management in cloud computing into three periods, as shown in Table 1.

3. Limitation of Centralize Data Centre

In the centralize system, storage of cloud computing & computing resources are centrally managed. In the logistics management of supply chain management, where no of distribution centers dispersed on different regions. The centralized system keep the record of delivery information and also services using a centralize data center. Due to this reasons, there are more chances of network congestion, as well this issue will also occur because of load over data center. So ultimately firms need to use multiple load balancing techniques. However, there also will be probability to increase/increment in latencies because off higher demand of any particular service.

4. Importance of Cloud Technology in Supply Chain Management

In the technology of cloud computing, the supply chain applications are innovative and generate a new research field. In the supply chain, by cloud

services two or more companies, partners are linked to provision of cloud services, related fund and information.

Table 1: The Execution Process of Supply Chain Management on Cloud Platforms

2010 to 2011	2011 to 2013	2013 to 2015
Characteristics of Providers & Processes	**Characteristics of Providers & Processes**	**Characteristics of Providers & Processes**
In starting pilot study of supply chain management using cloud require innovation, continuous Improvement. Attitude and testing also required.	This period captures maturing stage, first providers disappears from the market & other invest to grow and/or improve offering service.	This is a consolidation stage begin and main player in every stage/ category of supply chain management defined. Supply chain admit well establish models for payment & usage of cloud services.
Administrative and support processes. This can be isolated easily, and do not need very complex and difficult integration.	Focus over core rather than complex processes	Complex process also included in cloud such as need collaboration among several echelons, close-fitting integration with other processes as well also involving physical constraints of capacity.
Examples: simple analytics, capability training/development delivery	Examples: Replenishment Planning, processing of order, optimization of pricing and transportation load building	Examples: warehousing & distribution of goods, collaborative engineering, processing of reverse logistics, fleet management
Client/User group interests	**Client/User group interests**	**Client/User group interests**
Organizations with pressure for operational excellence, by competition such as consumer goods, High-tech	Wider industry scope or choice, firms with integration needs will begin using cloud services as part of their operating model	All sectors or industries applied processes of cloud based

4.1 Planning and Forecasting

Cloud-based platforms are going to support and help organizations in improvement of their services levels through coordination and collaboration the whole supply chain partners that are playing a significant role in the demand forecasting. The technology of cloud based platforms receive data from internet and then perform operation such as analytics to estimate accurate demand forecast for all

partners of supply chain. This will also help to be aware from the unusual or dynamic/ volatile demand, and somehow supply chain partners can handle it before the problem occurs.

4.2 Sourcing

In the stages of sourcing includes; receipt, inspection, acquisition and process of whole procurement. The cloud based platform run on database contains multiple data from various suppliers which gives distinctive advantages to organizations. Companies are also able to select appropriate supplier for their products or services (which supplier fulfill the specification requirement and able to provide material, components or services in time). Cloud based tolls also make manufacturer firms and suppliers to mutually develop contracts.

4.3 Inventory management

Due to the usage of wireless services and barcoding, many companies improve their inventory management in better way. The technology of RFID (radio frequency identification device) systems integrates with the cloud based centralized data management system for tracking of any goods, products across the supply chain management globally.
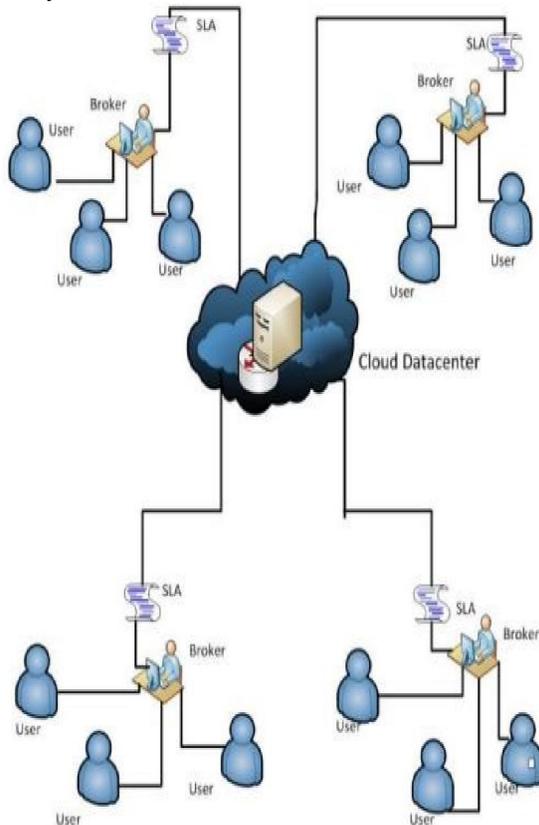

Figure 1: Architecture of Centralize Data Centre in Supply Chain Management

4.4 Product Development

Due to the usage of latest development in the technology, internet network transmission technology becomes more mature time-to-time. Its compatibility, security and stability are continuously improved and all application range is also increasing/ expanding. Collaborative of product development involved the usage of "design of product and development stages". All the process of development is shared on secure network among different companies. In these processes, marketing firms, specific information, test result, design changes and customer/client feedback are includes.

4.5 Logistics Management

In the logistics management, process of material, transportation and warehousing processes are includes. The system of logistics information management keep complete track of inventory information through using logistics management under cloud provides following advantages:

1. Parallel request of consumers and use computing capabilities without intervention of labor/ worker with their service provider. Here access of internet allows users to consume capabilities of computing through means of client's platforms like notebooks, cell phone or computers.

2. To fulfilling the demand of consumers (multiple consumers), the service provider of cloud computing pooled their resources together. The provider dynamically allocates or reallocates virtual and/or physical resource to clients. On other side, consumers have no knowledge regarding the resource location which is allocates to consumers.

3. The technology of cloud computing have the ability of providers to quickly add and release the resource in short period of time to match changes in consumer demand. This should be completed in very efficient and organized manner.

4. Scalability means, systems are able to bear the workload and also maintain their performance level. Whereas an elastic system vigorously add / release more resources, when service demand growing or minimizing respectively. So elasticity adds vigorous, dynamic component to scalability.
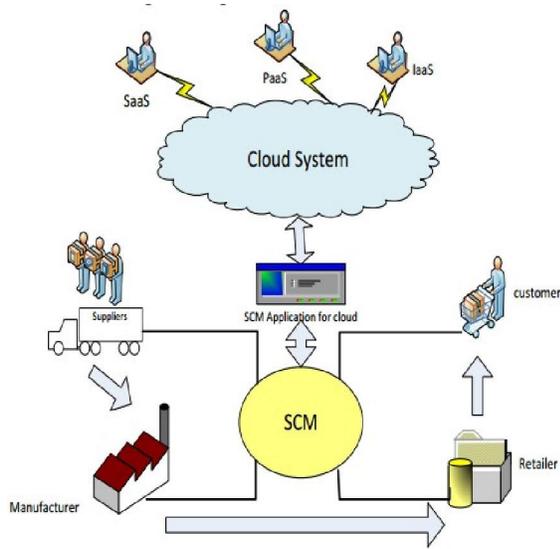
Figure 2: Supply Chain Management structural design in Cloud Computing

5. Impact of Cloud Computing

In the system of cloud computing, using various technologies such as virtualization, standardization technology, platform management and data management technology in supply chain information collaboration. The major and basic advantage of cloud computing system is flexibility. It has the ability to decrease/increase computing power according to the requirement of client and it's called scalability. Computing service availability to clients/users is ensured by scalability. In the system of supply chain management, scalability is the very important issue. Because in the nature, supply chain management system is distributed and every company wants to increase or grow his supply & distribution, at broad level, here should be require to scale information technology services of SCM (supply chain management). In the cloud system, distributed datacenter offer more improved traffic & bandwidth for clients of supply chain.

Cloud offer on demand services through which a user of supply chain use whenever he required. The organization, which is using supply chain, has multiple branches across the regions and countries. If any firm's supply chain distributed globally then it needs a different infrastructure of cloud for every of their branches. Sharing of information in supply chain should be secure and reliable between all clients/users of supply chain, so there is require of its own private cloud system. In private cloud system, sharing of information has done secure and reliable way. So besides using a centralize cloud data center, an organization should use distributed data center under private cloud premises/circumstances.
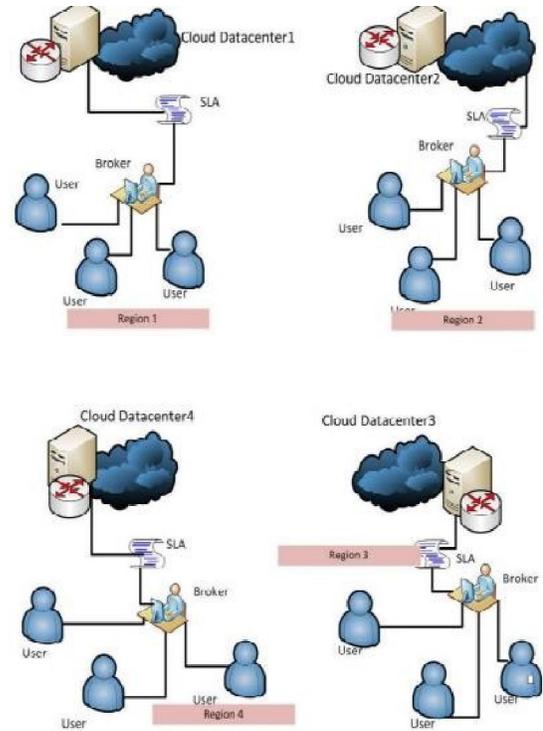

Figure 3: Distributed Cloud Datacenter

Following are the mainly advantages of private cloud:

5.1 Scalability

The system would scalable, if cloud offer minimum amount of latencies throughout collaboration and sharing of information among two or more than two clients/users.

5.2 Efficiency

The system of centralized takes request from clients globally which build more pressure and loads over servers. There will be probability of raise in latency. As well, this may create delay of time among request & response. On the other side, local datacenter under distributed cloud environment offer more quick response to their clients.

5.3 Security

In the private system of cloud, company builds their security policy as per their own needs. If it is distributed then policy may have broader effect due to their regional sharing of information's policy for distinctive client in distinctive regions/country.

6. Conclusion

In the supply chain, companies are firstly beginning using the technology of cloud computing for their services and also make supply chain for efficient. The several cloud architecture is available

& require exploring fully utilized & scalable infrastructure of cloud. In this research article, we shown, how supply chain may adopt cloud computing for their information technology related services. As well also shown an infrastructure of distributed cloud datacenter instead of centralize, which offer more scalable and efficient infrastructure for all partners and/or users of supply chain which reside in distinctive countries and regions. In the research paper, explained architecture is very suitable; where sharing information and tracing information is highly required such as tracking of shipments, forecasting etc. Therefore firms who are willing to make better their services at broader scale may use distributed cloud datacenter.

ACKNOWLEDGMENTS

References

[1] Joerg Leukel, Stefan Kirn, and Thomas Schlegel, "supply chain as a service: A cloud perspective on supply chain systems", Vol. 5, No. 1, IEEE Systems Journal, PP. 16-27, March 2011.

[2] M. Armbrust, A. Fox, R. Griffith, A.D. Joseph, R. Katz, A. Konwinski, G. Lee, D. Patterson, A. Rabkin, I. Stocia, and M. Zaharia, "Above the clouds: A Berkeley view of cloud computing", Technical Report, EECS Department, University of California, Berkeley, Pages 1-23, February 2009.

[3] R. W. Lucky, "Cloud Computing", IEEE Journal of Spectrum, Vol. 46, No. 5, Pages 27-45, May 2009.

[4] M. D. Diakaiakos, G. Pallis, D. Katsa, P. Mehra, and A. Vakali, "Cloud Computing: Distributed Internet Computing, Vol. 13, No. 5, Pages 10-13, September/October 2009.

[5] Raj Kumar Buyya, Chee Shin Yeo, and Srikumar Venugopal, "Market-Oriented Cloud Computing: Vision, Hype, and Reality for Delivering IT Services as Computing Utilities" 10th IEEE International Conference on High Performance Computing and Communications, HPCC 2008, IEEE CS Press, Los Alamitos, CA, USA.

[6] Shuangqin Liu and Bo Wo, "Study on the supply chain management of global companies", International Conference of E-business and E-Government, Guangzhou, People's Republic of China, Pages 3297-3301, 7-9 may 2010.

[7] B. Andal Supriya and IIango Djearamane, "RFID based cloud supply chain management", International Journal of Scientific & Engineering Research, Vol.4, Issue 5, PP. 2157-2159, may-2013.

[8] Chen Jun and MA YAN WEI, "The Research of Supply Chain Information Collaboration Based on Cloud Computing" Procedia Environmental Sciences 10, PP. 875-880, 2011.

[9] Bowersox, D.J. and D.J. Closs "Logical Management: The Integrated Supply Chain Process", New York, U.S.A, McGraw-Hill Companies, 1996.

[10] Thomas Schramm, Jonathan wright, dirk seng and derk jones "six questions every supply chain executive should ask about cloud computing", ACC10-2460/11-241, http://www.accenture.com.

[11] Raj Kumar Buyya, Chee Shin Yeo, and Srikumar Venugopal, Market-Oriented Cloud Computing: Vision, Hype, and Reality for Delivering IT Services as Computing Utilities" 10th IEEE International Conference on High performance Computing and Communications (HPCC 2008, IEEE CS Press, Los Alamitos, C.A, USA), September, 25-27, 2008, Dalian china.

[12] Eirini Aivazidou, Antonios Antoniou, Konstantinos Arvanitopoulos and Agorasti Toka "Using Cloud Computing in Supply Chain Management: Third-Party Logistics on the Cloud", Second International Conference on Supply Chains, Aristotle University of Thessaloniki, Greece, 2012.

11/25/2015