

Influences of Cloud Computing On E-Commerce

Mohit Singhal

Abstract - Cloud computing is a new and highly talked about subject in the current IT Sector. This sector has tremendous amount of research and innovation put into this sector. Cloud computing is the next generation of computing comprising a mixture of parallel processing, distributed and grid computing. Cloud computing has also been referred to as “shared computing” in the past decades. E-Commerce is the exchange of consumer goods and services on the internet. This sector is a fast paced and a highly fragile part of the IT industry. It is still a sector which needs much in-depth research and development in the context of Indian Marketplace. Companies have tried the model over the past several years and some very successful companies have emerged from the implementation of the model like Flipkart, SnapDeal, Mynta etc. This paper discusses the impacts of cloud computing on the traditional and also presents the problems of E-Commerce businesses in the cloud era.

Keywords: Cloud computing, E-commerce, multi clouds

I. INTRODUCTION

A Cloud is a type of parallel and distributed system consisting of a collection of inter-connected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resource(s) based on service-level agreements established through negotiation between the service provider and consumers[1]. According to the type of service, the application mode of cloud service can be divided into Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS)[2].

Cloud computing has been revolutionising the IT industry by adding flexibility to the way IT is consumed, enabling organisation to pay only for the resources and services they use. Clouds vary significantly in their specific technologies and implementation, but often provide infrastructure, platform, and software resources as services [3, 4].

Manuscript received Aug 06, 2015.

Mohit Singhal, Jaypee University of Information Technology, Solan, India.

Cloud computing provides an unreal group of resources e.g. networks, storage, central processing unit and memory to carry out users specific requirements. Sometimes it is also referred to as dynamic computing because of its stack of resources and allocation of these resources based on the user or industry specific requirements.

Cloud computing has reduced the work of servers in the mainstream IT industry. It has provided users the power to store as much data in a safe and encrypted form and has also reduce the amount of external storage devices that we have to carry to places for various purposes and sophisticated users like programmers to store data in an efficient manner where chances of hacking and leaking of data is minimum.

The rest of the paper is framed like section 2 deals with the related work done in the field of cloud computing and e-commerce and the major issues. Section 3 talks about the multi clouds and its methods. Section 4 deals with the proposed work. Finally section 5 concludes and proposes the future work.

II. RELATED WORK

This section deals with the influences of cloud computing on E-commerce model and the major issues.

A. Influences on Technical Architecture for E-commerce

E-Commerce model is based on two layers: First layer being the technical architecture which consists of hardware and software; the other being the business transactions based on technical architecture. According to Laudon [6], the technical architecture is the base of E-commerce. E-commerce business models and market strategies are realized on the base of the technical architecture. Moreover, the security and stability of technical architecture are the premise of online products and services exchange. Since cloud computing is relatively new in the field of cloud computing it would have a major impact on the basic foundation of the existing E-Commerce model.

The major problem an E-Commerce company face is the storage of these huge amounts of data and all the information of the products they

are selling. This means that company have to set up their own databases and have to maintain these databases by themselves which means huge investment in the set up of these hubs. But with the introduction of Cloud Computing, companies don't need to worry about the backend of their company structure. The implementation of the environment of the e-commerce software and hardware are all handled by the service providers of the e-commerce cloud. Enterprises only need to access the software libraries which are built by the services provider. Then the enterprise will get the management processes and commercial database information they need There is no need to solo invest and establish the whole internal software and procedures, the cost is relatively low, it only needs to pay the rent [7]. EC2 (Elastic Compute Cloud), offered by Amazon allows users to rent the application or the storage space in the cloud [5].

B. Influences on Backend Service Mode

The service mode which is offered by cloud computing differentiates it from the traditional Information Technology (IT) services. Firstly, all the IT resources such as hardware, software, data and infrastructure are offered to the E-commerce enterprises as service by virtue of the cloud platform [8 and 9]. Secondly, just like the utility services (e.g. electricity), an E-commerce company is allowed to access the IT resources on the cloud platform and pay for them as services [10]. The emergence of cloud computing brought the new service philosophy and mode which enables the lower cost and challenges the traditional IT licensing mode. The basic contribution of cloud computing is the integration of outsourcing into e-commerce. The cloud company to which e-commerce is outsourced establishes the standardized and uniform service platform and then merges its platform with the application software and then customize these services based on the needs of the potential customers. The backend service mode based on cloud computing changes the close-end service that the service provider has to send the IT personnel to conduct local technical support and is called as "outsourcing 2.0" [11]. The basic aim of outsourcing is to drastically reduce head cost, improve the overall efficiency as well as service quality and progress the core competencies of an organization. Virtual business is the typical example of the new outsourcing based on cloud computing. It refers to that an E-commerce firm fulfils most of its functionalities through "cloud-outsourcing" [12].

C. Influences on Industry Chain Structure

Conventionally, the E-commerce industry chain is composed of hardware supplier, software developer, system integrating provider, internet

service provider, E-commerce enterprise, service supplier and customer. This is the basic backend of the E-commerce enterprise. All of the chains go hand in hand and offers it the technical support.[13]

But when cloud is introduced in the existing E-commerce environment, one cloud service provider can supply almost all the necessary products and services to an E-commerce website. An E-commerce enterprise just rents the cloud services needed, it doesn't have to purchase the IT. Thus, the profiting space of the traditional IT firms (e.g. IT service provider) in the chain will become smaller. They may cooperate with a cloud service provider and become its "backend" which offers the necessary infrastructure services for the cloud service provider. The E-commerce enterprise will be directly served by the cloud service provider rather than the IT firms group. That means the IT resources market of the traditional E-commerce website will be partly shared by cloud computing. [13]

D. Major Issues

Cloud Computing is still in its very initial stages and safety is one of its main issues. The amalgamation of cloud computing and E-commerce has still not reached advanced stage and still needs testing. At present these are the many problems that are to be resolved.

1) Security issues of cloud platform [14]

The traditional security requirements, such as the legitimacy of authority, information integrity, no repudiation, authenticity of identity issues are easier to be solved in the cloud computing model. However, the confidentiality of information, network security and some other issues haven't been solved yet.

2) Challenges [15]

For some e-commerce companies, entrusting the work to the third party contains some elements of risks. Going too much, the risks may be greater than the benefits for the business.

3) Cloud data security [14]

Cloud data security includes data security and confidentiality of privacy. Currently, private cloud, public cloud, mixed clouds and other concepts have been proposed and gradually applied to practice, but whether they are effective remains to be further verified.

4) Privacy

One of the biggest challenges for a firm is to protect the sensitive information about their customers like Credit/Debit card information and other personal information. In the modern cloud based architecture theft of sensitive information has become a trend, with photos being leaked from

iCloud and hack of Sony Inc. Implementation of cloud still pose many challenges for an E-Commerce business.

5) Reliability

E-Commerce applications are now so critical that they must be reliable and available to support 24/7 operations. In the event of failure or outages, contingency plans must take effect smoothly, and for disastrous or catastrophic failure, recovery plans must begin with minimum disruption. Each aspect of reliability should be carefully considered and tested in fail over drills [16].

6) Laws and Norms

Different countries have their own laws and norms in the sector of data privacy and have protocols on which if a company wishes to set up a cloud based model must follow. Currently some global technological and political powers are in process to assert certain laws that would have a negative effect for companies who wish to implement cloud. For example, as a result of the USA Patriot Act, Canada has recently asked that its government not use computers in the global network that are operating within U.S. borders, fearing for the confidentiality and privacy of the Canadian data stored on those computers [16].

7) Recovery

To manage such a huge amount of data, the data is segmented. This creates great difficulties to create backups in case of a failure.

III. MULTI CLOUDS

Multi clouds, Clouds of Clouds [17] are similar term used to show that despite the limitations already stated. Cloud Computing should never be restricted to a single cloud infrastructure as it has many limitations and data in that infrastructure is not protected. Cloud to multi-cloud is mandatory to fulfil the data security needed in E-commerce market. Here we would discuss the various methods of multi-Cloud that are available.

A. BFT(Byzantine Fault Tolerance)

Distributed computing suffers from reliability problems and availability, the installed services are becoming more open to the world, and a significant load on the servers is increasing. In addition, the failure in deployed services and network can happen unexpectedly. Replication is a crucial technique used to maintain system reliability by having multiple backup servers (or redundant replicas). Replication aims to raise the availability and performance of the system while ensuring its correctness. A BFT [17] protocol is used to manage communication between replicated systems and clients. This protocol requires at least 3f replicas to ensure consistency between replicas

of the system, where f represents the replicas that can be byzantine.

B. Deep Sky

Bessani et al. [18] propose a virtual storage system called DepSky. It is a coexistence of several clouds to build a cloud of clouds. DepSky improves the availability, integrity and confidentiality of information stored in the cloud through the encryption, encoding and duplication of data. The DepSky system ensures the availability and confidentiality of data stored in different cloud providers by using the multi-clouds architecture and the association of “the algorithm of byzantine failures tolerance, secret sharing and erasure codes cryptographic”. The DepSky architecture consists of four clouds and each cloud uses its own detailed interface. The DepSky system consists of two algorithms:

1. DEPSKY-A (Available DepSky): brings the accessibility and integrity of data by duplicating storage on different clouds using quorum methods.
2. DEPSKY-CA (Confidential & Available DepSky): the lack of confidentiality is the major drawback of DeepSky-A because the storage of data is in cleartext, Depsky-CA algorithm encrypts data before storing them in the multi-Clouds with a symmetric encryption, then the data is divided into block as: $f+1$ blocks are necessary to recover the original data.

C. IC Store (Inter Cloud Storage)

IC Store [19] allows access to private or public cloud providers to migrate third, save or share files. The advantage of the solution is to protect against downtime, data loss or hacker attacks. Another advantage is filled more easily switch providers migrating all data from one cloud to another. ICStore client consists of three corelayers that target different dependability aspects: i) confidentiality, ii) integrity and iii) reliability and consistency (RC).

The Layered interface gives the user the capability to switch “on” or “off” any layer at any point of time. Major limitation is that it has no secret sharing algorithm for the confidentiality.

Infrastructure	Data Integrity	Privacy
Dep Sky	✓	✓
IC Store	✓	

Table 1. Existing Security Mechanisms in Multi-Clouds

From the above table it is clear that deployment of Dep Sky Mechanisms can be very helpful for an E-commerce company as it ensures Data Integrity as well as Privacy of the data which is required by all the ecommerce companies. But

there is a drawback in using Dep Sky. It although insures privacy but to a very limited part of the data and sensitive data might be left out.

IV. PROPOSED WORK

To curb the problem faced by Dep Sky, we propose to integrate the RSA encryption algorithm as shown in the Figure 1. This technique can most effectively reduce the problem of stealing of sensitive data of the customers. We now define the RSA algorithm

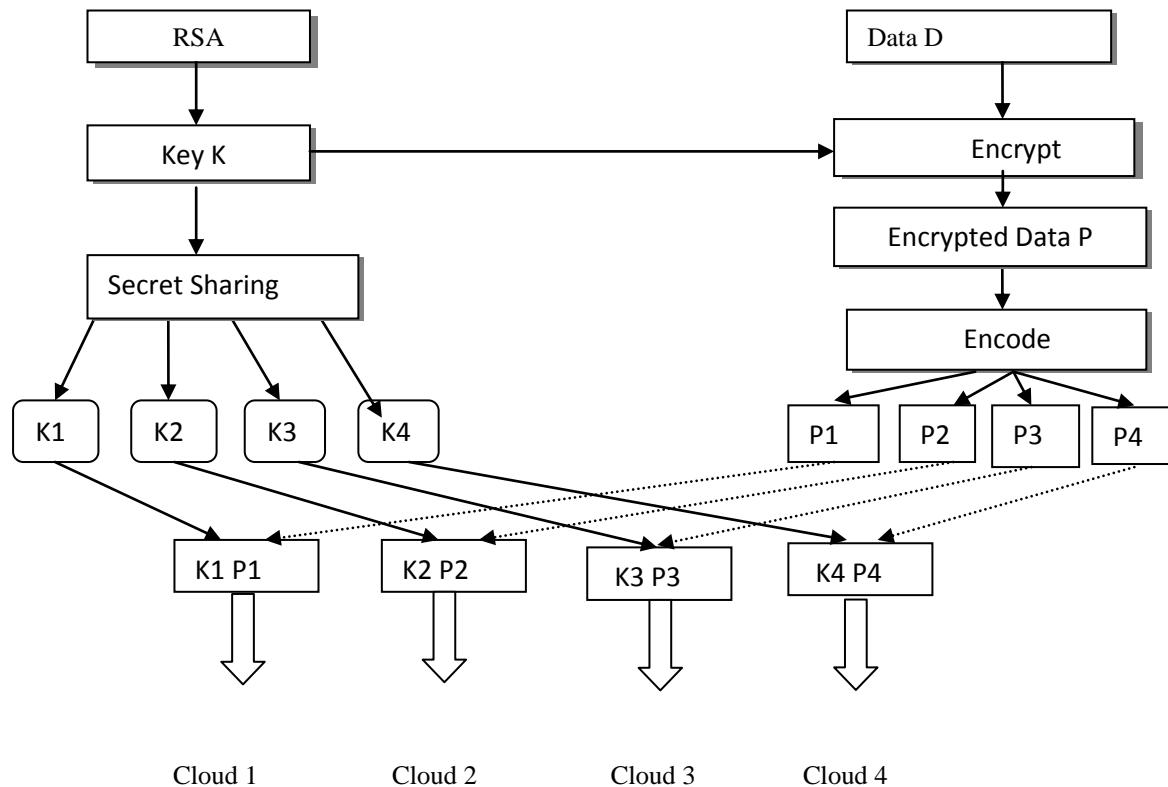


Figure 1: RSA in DepSky

Algorithm: Generate an RSA key pair.

INPUT: Required modulus bit length, k .

OUTPUT: An RSA key pair $((N, e), d)$ where N is the modulus, the product of two primes $(N=pq)$ not exceeding k bits in length; e is the public exponent, a number less than and co prime to $(p-1)(q-1)$; and d is the private exponent such that $ed \equiv 1 \pmod{(p-1)(q-1)}$.

1. Select a value of e from $\{3, 5, 17, 257, 65537\}$
2. **repeat**
3. $p \leftarrow \text{genprime}(k/2)$
4. **until** $(p \bmod e) \neq 1$
5. **repeat**
6. $q \leftarrow \text{genprime}(k - k/2)$
7. **until** $(q \bmod e) \neq 1$
8. $N \leftarrow pq$
9. $L \leftarrow (p-1)(q-1)$
10. $d \leftarrow \text{modinv}(e, L)$
11. **return** (N, e, d)

Following would demonstrate how to check whether the number is prime or not

1. $\text{genprime}(\text{num})$
2. Set $t=2$
3. **while** $t \leq \text{num}/2$
4. **if** $\text{num} \bmod t = 0$
5. **exit**
6. $t=t+1$
7. **if** $(t=(\text{num}/2)+1)$
8. **Return** num

If RSA is implemented in the Dep Sky architecture then it would not only increase the protection of data but also privacy of the critical data. It would also reduce the selling of data to the third party organization as the time taken to decrypt data would now take much time than the simple implementation of Dep Sky because after implementing RSA encryption the time taken is $O(\lg n^3)$. Tough this is the main disadvantage of implementing RSA in Dep sky but since privacy is the main concern of any E-commerce company is to preserve the sensitive data of its customers, running time of

$O(\lg n^3)$ won't be a big problem. Figure 1 shows the proposed architecture that should be used. Here we have implemented RSA on the Key T so that there is a set of public key and a set of private key. The set of public key would go to the Data D, since the encryption key is public it would be visible to the third party. The main advantage here is that the private key set which is left is only know to the client and hence when the keys are made it contain that private key which is only know to the client hence its decryption takes time. Rest of the things are same as stated in Dep Sky-CA algorithm, except the fact that we have used asymmetric encryption in place of symmetric encryption.

To demonstrate how the encryption and decryption work in RSA here are the codes of the functions:-

```
void encrypt()
{ long int pt,ct,key=e[0],k,len;
  i=0;
  len=strlen(msg);
  while(i!=len)
  { pt=m[i];
    pt=pt*96;
    k=1;
    for(j=0;j<key;j++)
    {
      k=k*pt;
      k=k%n; }
    temp[i]=k;
    ct=k+96;
    en[i]=ct;
    i++; }
  en[i]=-1;
  printf("\nTHE ENCRYPTED MESSAGE IS\n");
  for(i=0;en[i]!=-1;i++)
    printf("%c",en[i]); }
void decrypt()
{long int pt,ct,key=d[0],k;
  i=0;
  while(en[i]!=-1)
  {
    ct=temp[i];
    k=1;
    for(j=0;j<key;j++)
    {
      k=k*ct;
      k=k%n;
    }
    pt=k+96;
    m[i]=pt;
    i++;
  }
  m[i]=-1;
  printf("\nTHE DECRYPTED MESSAGE IS\n");
  for(i=0;m[i]!=-1;i++)
    printf("%c",m[i]);
}
```

V. CONCLUSION AND FUTURE WORK

If RSA is implemented in the Dep Sky architecture then it would not only increase the protection of data but also privacy of the critical data. It would also reduce the selling of data to the third party organization as the time taken to decrypt data would now be much higher than the simple implementation of Dep Sky.

As mentioned, a good amount of time is required to decrypt the data. In the future the authors wish to remove this drawback by incorporating some time efficient decryption algorithm.

REFERENCES

- [1] Cloud Computing and emerging IT platforms : Vision, hype, and reality for delivering computing as the 5th utility : Future Generation Computing Systems (2008) pg 601.
- [2] M. V. Luis, R. M. Luis, C. Juan, L. Maik. A Break in the Clouds: Towards a Cloud Definition. Computer Communication Review, vol.39, pp.50-55, 2009.
- [3] R. Buyya, C. S. Yeo, S. Venugopal, J. Broberg, I. Brandic , Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility, Future Generation Computing Systems 25 (6) (2009) 599-616.
- [4] M. Armbrust, A. Fox, R. Griffith, A. D. Joseph, R. H. Katz, A. Konwinski, G. Lee, D. A. Patterson, A. Rabkin, I. Stoica, M. Zaharia, Above the Clouds: A Berkeley View of Cloud Computing, Technical report UCB/EECS-2009-28, Electrical Engineering and Computer Sciences, University of California at Berkeley, Berkeley, USA (February 2009).
- [5] LaMonica, Martin (March 27, 2008). "Amazon Web Services adds 'resiliency' to EC2 compute service". CNet News. Retrieved August 1, 2009.
- [6] K. C. Laudon and C. G. Traver, "E-Commerce: Business,Technology, Society," 2nd Edition, Addison Wesley Publish,Boston, 2001.
- [7] ShenJuncai and Qian Shao, "Based on Cloud Computing E-commerce Models and Its Security" , International Journal of e-Education, e-Business , e-Management and e-Learning, Vol. 1, No. 2,June, 2011.
- [8] R. L. Grossman, "The Case for Cloud Computing, *IT Professional*, Vol. 11, No. 2, 2009, pp. 23-27.
- [9] G. Boss, P. Malladi, D. Quan, L. Legregni and H. Hall, "Cloud Computing," IBM White Paper,2007.http://download.boulder.ibm.com/ibmdl/pub/software/dw/wes/hipods/Cloud_computing_wp_final_8Oct.pdf.
- [10] L. Z. Wang and G. von Laszewski, "Scientific Cloud Computing: Early Definition and

- Experience,” *Proceedings of High Performance Computing and Communications*, Dalian, 25-27 September 2008, pp. 825-830.
- [11] H. T. Qi, “Serving in the Cloud,” *Finance Outsourcing*, 2010.
- [12] H. R. Motahari-Nezhad, B. Stephenson and S. Singhal, “Outsourcing Business to Cloud Computing Services: Opportunities and Challenges,” HP Laboratories.
- [13] Danping Wang, “Influences of Cloud Computing on E-commerce Businesses and Industry”, *Journal of Software Engineering and Applications*, 2013, 6, 313-318.
- [14] M. Tim, K. Subra, L. Shahed. *Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance*. O'Reilly Media, Inc., 2009
- [15] S. Dan, C. Roger. Privacy and consumer risks in cloud computing. *Computer law and security review*, vol.26, pp.391-397, 2010
- [16] Maricela-Georgiana Avram (Olaru),”Advantages and challenges of adopting cloud computing from an enterprise perspective,” *Procedia Technology* 12 (2014) 529-534.
- [17] MAHA TEBA, SAID EL HAJJI, “From Single to Multi-Clouds Computing Privacy and Fault Tolerance,” *IERI Procedia* 10 (2014) 112-118.
- [18] Bessani and al. «DEPSKY: Dependable and Secure Storage in a Cloud-of-Clouds», *EuroSys'11*, Salzburg, Austria, 2011.
- [19] Fernando Martins André, Thesis «Availability and Confidentiality in Storage Cloud», 2011.



Mohit Singhal is third year student of Computer Science Engineering at Jaypee University of Information Technology. He has published three research papers in conference proceedings. He is member of IEEE Student Branch at JUIT, Member of photography club, JUIT Youth club (JYC) and Member of Rotract Club of Wagnaghat. He has participated in Tamron photography challenge in 2014 and also participated as “Delagate of Sweden” in IIT Roorkee TechFest MUN, 2014.