Minimizing the Network Overhead Load for Virtual Desktop Infrastructure

Thirumanapally Prashanth
Master of Technology, Hasvita Inst. of Sc.& Tech
R.R District, Telangana, India

Gundu Purna Chandar Rao
Research Scholar, Osmania University
Hyderabad, Telangana, India

Abstract: Over the past decade, cloud computing services become pervasive in the industrial field in order to enhance the efficiency and reduce the TCO (Total Cost of Ownership). Virtual desktop infrastructure (VDI) provides the computing environment to the client, where the host server delivers the video images encoded on the host server. The client decodes the video images and then displays them on the screen. However, this scheme causes the heavy traffic and increases an overhead on the host server due to the frequent memory access. In this paper, we propose a novel method for reducing the network traffic and decreasing an overhead on the host server through the cyclic redundancy check (CRC) comparison of each frame. Experimental result shows the feasibility of our proposal.

Keywords: VDI, VDI protocol, Zero Client, Cloud Computing, Cyclic Redundancy Check.

I. INTRODUCTION

As cloud computing services become pervasive, vendors are offering rich features supported by cloud-based servers. But in this case, a client needs a high computing performance and the high network bandwidth utilization to guarantee the high quality of cloud service. Furthermore, an overhead is increased on the host server due to the frequent memory access and data transmission. In terms of a zero client, Virtual Desktop Infrastructure (VDI) protocol is required between the host server and the client as a zero client has a fewer computing resource compared to the conventional clients such as smart hand held devices [1-2]. Our key idea is reducing the raw bitmap size through a novel VDI protocol thanks to redundancy between the past frame and the current frame.

In the cloud computing service, the VDI is a technique for running desktop operating systems and applications inside Virtual Machines (VMs) that reside on the host server, where VDI protocol is responsible for high availability service of cloud computing [3].

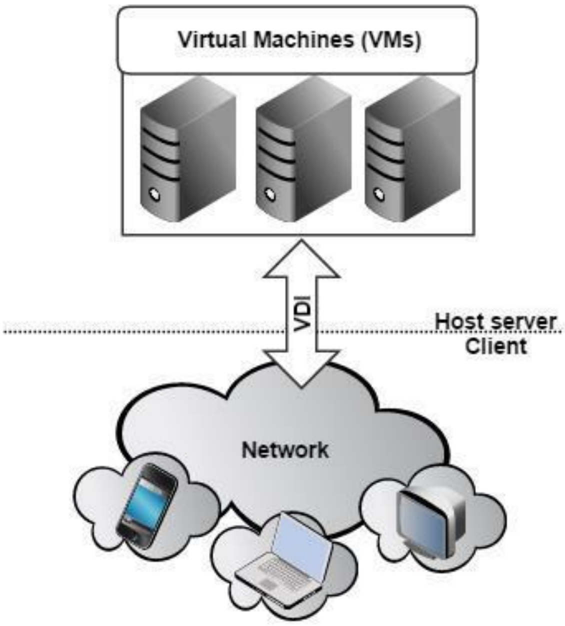

Figure 1. Overview of the cloud computing service

Figure 1 shows the overview of cloud computing service. Users access virtual machine remotely using VDI through network. Since the operating systems and applications are supervised centrally at the host server, clients are allowed to gain better management and security over their clients without degrading the user experience on traditional PC environments [4]. In cloud environments, several kinds of virtual machines are hosted on the same physical server as infrastructure [5]. Thin clients are light, easy to use and consume low power as compared to traditional PC and solution with lower total cost [6]. *Arumaithuraiet. al.* proposed the multiple thin client connections which run through a middlebox to the data server to provide preferential enhance quality of experience (QoE) [7]. Also, a scheduler-based screen update transmission was proposed [8]. When congestion is detected, the server applies a scheduling to treat all pending updates for reducing the network traffic.

In this paper, we propose the screen data transmission methodology supporting zero cloud computing services. The main contributions of this paper are the reduced network traffic by using the cyclic redundancy check (CRC) and verification of the methodology with the software realization.

II. CRC BASED FRAME COMPRESSION

In order to implement the cloud computing service on portable devices, the VDI is the essential technology for various screen sizes. Among the input and output signals of virtual desktop, the screen data accounts large portion of the network load. When the host server transmits screen data to the virtual desktop, we can achieve the decreased network burden by judging the change of screen data. In this sequences, it requires a number of encoding for high quality of service (QoS) The CPU on the host server converts the successive screen data into the form of frames or sub blocks, and compares with the previous screen data. If there are no differences between same frames, the hostserver transmits 'remaining' signal to the zero client. On the other hand, the host server encodes changed screen data, and the zero client receives the image data which needs to be decoded on zero client.

Then, this method is more efficient compared with transmitting whole of screen data on host server. Our system compares the difference of the current and previous frames by using CRC, which is commonly used to test the integrity of the process in data transmission or data compression, due to its good error detection and amenability to fast encoding and decoding implementations on hardware [9]. Moreover, adoption of CRC reduces computing power and memory access of the server.

III. EXPERIMENTAL RESULTS

In order to show the benefit of our proposal, we selected a portable document file (PDF), which is frequently used application on usual desktop computer, for analysis. Every screen data is 30 seconds long and the resolution is 640×480. To simulate reading documents in zero client, a PDF format document is scrolled to the end of file.

Figure 2 shows the flow of the analysis which includes computation for changed frames and calculation total traffic. Height and width size of video are extracted in order to determine the size of sub block. Every frame of sample video is stored into the structural data. Divided frame is compared with previous frame. If there is any difference with previous frame, its difference data is stored into structural data refers as 'frame diff'. In previous stage, divided frames are not separated by the color. RGB color difference calculation is conducted, respectively. After RGB difference computation, with using logical OR operation, RGB differences are operated with 'frame diff'.

Then, merged data is stored into new structural data refers as 'merge diff'. Every sub block is compared with previous frame's sub block. 'HD' is the number of horizontally divided blocks. Also, 'VD' is the number of vertically divided blocks. Then, the number of sub blocks is defined with the multiplication of HD and VD and the size of sub block is sample video resolution over the number of sub blocks. Detection for changed sub block and frame is computed as same way as RGB differences. Every sub block is compared with previous sub block and detect changed frames. Then, count the number of sub blocks which needs to be re-transmitted from host server. Finally, the total workload, which indicates the network traffic, is calculated with the sum of merge diff, sub block size, and bits for pixels. Figure 3 illustrates the network workload analysis result of PDF. When the sub block size decreases, the network workload also decreases. As a result, without considering the overhead of the network transmission, the network traffic is decreased with our frame transmission method.

IV. CONCLUSIONS

This paper presented the way to realize VDI for zero-client cloud computing with variation of block size. Experimental results demonstrated that the proposed cyclic redundancy check based comparison of each frame can reduce the network traffic for cloud computing. As dividing screen into small sub blocks, the workload for screen transmission decreased. Our results showed that transmitting changed frame is better way for networkcompared to transmitting entire screen data. The cloudcomputing needs high QoS for data transmission. With proposed method, we expect that low network traffic can be achieved by adapting on VDI protocol for zero client computing.

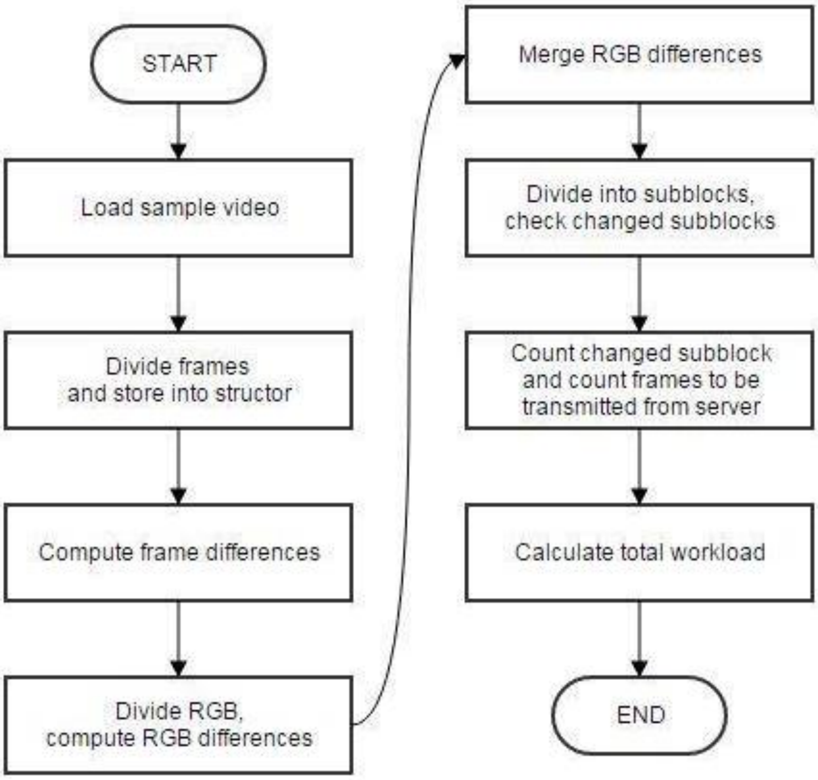

Figure 2. Workload analysis flow

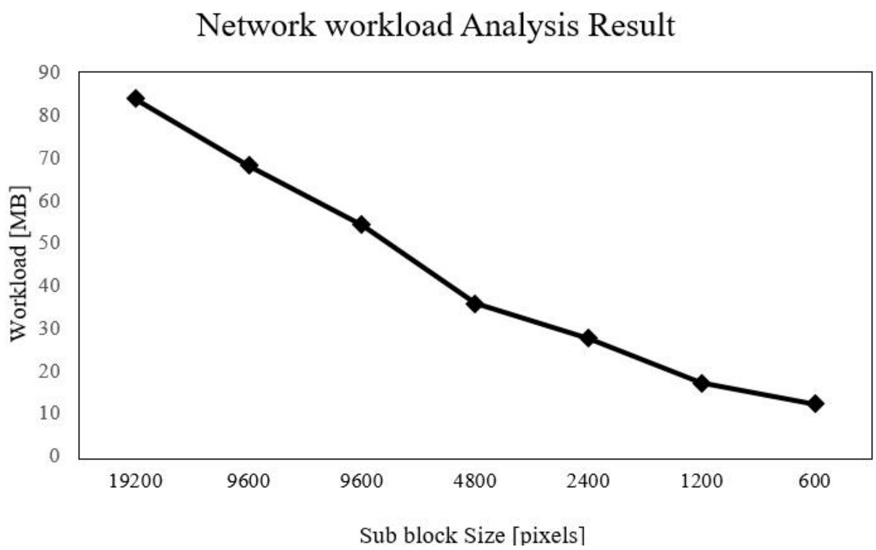

Figure 3. Network workload analysis result

REFERENCES

[1] Sang Don Kim and SeungEun LEE, "A Scalable Large Format Display Based on Zero Client Processor,"International Journal of Electrical and Computer Engineering (IJECE), vol.5, no.4, pp.714-719, Aug. 2015.

[2] Sang Don Kim and SeungEun LEE, "Architecture for A Zero Client Based Scalable Large Format Display System," International Journal of Computer and Information Technology, vol.04, issue 03, pp.540-542, May. 2015.

[3] Soo-Cheol Oh and SeongWoon Kim, “ARM-based Thin Virtual Desktop Client Integrating Electrical Power Control with Monitor,” International Conference on Advanced Communication Technology (ICACT), pp. 749-752, 2015.

[4] Don-Anthony DaSilva, Lu Liu, Nik Bessis and Yongzhao Zhan, “Enabling Green IT Through Building a Virtual Desktop Infrastructure,” Eighth International Conference on Semantics, Knowledge and Grids (SKG), pp. 32-38, 2012.

[5] FarzadSabahi, “Cloud Computing Security Threats andResponses,” International Conference on Communication Software and Networks (ICCSN), pp. 245-249, 2011.

[6] S. U. Sharma and Y. B. Gandole, "Virtualization approach to reduce network latency for thin client performance optimization in cloud computing environment," Computer Communication and Informatics (ICCCI), pp. 1-6, 2014.

[7] M. Arumaithurai, J. Seedorf, M. Dusi, E. Monticelli and R. Lo Cigno, "Quality-of-Experience Driven Acceleration of Thin Client Connections," Network Computing and Applications (NCA), pp. 203-210, 2013.

[8] A. C. F. Fok, B. Lécroart, É Chan, P. Simoens and B. Dhoedt, "An adaptive approach to optimize thin client protocols," Future Network and Mobile Summit, 2010, pp. 1-9, 2010.

[9] Li-Chia Choo and Zander Lei, “CRC codes for short control frames in IEEE 802.11ah,” Vehicular Technology Conference (VTC Fall), pp. 1-5, 2014.

AUTHOR’S PROFILE

Thirumanapally Prashanth, is a Ph.D. aspirant and an employee in SC cell Hyderabad. He received his Master of Technology (CSE) in year 2014 from Hasvitha institute of science and technology, RR Dist. Telangana. He received his B.tech (CSE) in year 2012 from Tirumala Engineering college, RR DIst.Telaangana. His field of interest is computer network, Network Security, Cloud Computing and IoT(Internet of Things).

Gundu Purna Chandar Rao is a Research Scholar (Ph.D.) from department of CSE, University college of Engg. Osmania university. He received his master of computer appilications in year 2010 from Horizon Inst. Of Tech. BSc.From EVR Degree and PG college. His field of interest are computer networks, Network Security,Cloud Computing .

.