

iSCSI Multi-connection and Error Recovery Method for Remote Storage System in Mobile Appliance

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Abstract. The continued growth of both mobile appliance and wireless Internet technologies is bringing a new telecommunication revolution and has extended the demand of various services with mobile appliance. However, during working with wireless access devices, users have a limited amount of storage available to them due to their limited size and weight. To relieve this problem iSCSI (Internet Small Computer Interface) remote storage system would be one solution but the question is high availability and performance. In this paper, we propose a new approach of Multi-Connection in one session based remote storage system for mobile appliance with error recovery method that avoids drastic reduction of transmission rate from TCP congestion control in wireless environment as compared to traditional iSCSI.

1 Introduction

Mobile appliances, including cell phones, PDAs, and smart phone, account for a large segment of the electronics and semiconductor industries. Due to their convenience and ubiquity, it is widely accepted that such mobile appliances will evolve into "Personal trusted devices" that pack our identity and purchasing power, benefiting various aspects of our daily lives. However, when working with mobile appliances, users face many problems, such as: data that mobile appliances are storing are more vulnerable and loss-prone than stationary data because they can be easily damaged or stolen[1]. The limited storage capacity of mobile appliance will be obstruction for the adaptation of usable services of wired environment to mobile environment.

To alleviate these problems, we suggest a remote storage system for mobile appliance [2,3,4], which offers to its users the possibility of keeping large size of multimedia data and database in a secure space. Remote storage system provides allocated storage space to each client across networks. Since remote storage system can make mobile appliance access storage on a remote host, mobile appliance could be free from the limitation of storage capacity. Through remote storage system, we are not only reducing additional costs to purchase high cost memory for mobile appliance but also accessing mass storage anytime and anywhere and prevent data loss from an unpredictable breakdown of mobile appliance by improving remote storage performance and availability.

TCP performs well over wired networks by adapting to end-to-end delays and packet losses caused by congestion. The TCP sender uses the cumulative acknowledgments it receives to determine which packets have reached the receiver, and provides reliability by re-transmitting lost packets. The sender identifies the loss of a packet

either by the arrival of several duplicate cumulative acknowledgments or the absence of an acknowledgment for the packet within a timeout interval. TCP reacts to any packet losses by dropping its congestion window size before re-transmitting packets.

In a wireless environment, losses may also occur due to bad channel characteristics, interference or intermittent connectivity due to handoffs for example. Based on these losses, congestion control mechanism would lead to a reduction of the transmission rate and would only decrease the link utilization unnecessarily. iSCSI over TCP performance in such networks suffers from significant throughput degradation and very high interactive delays. Therefore, in this paper we propose iSCSI Multi-Connection and Error Recovery Method in one session for mobile remote storage system to avoid drastic reduction of transmission rate from TCP congestion control mechanism or guarantee fast retransmission of corruptive packet without TCP re-establishment. The Multi-Connection in one session is defined to be a collection of one or more TCP connections connecting mobile client to remote storage server in iSCSI one session. If packet losses occur due to bad channel characteristics in a specific TCP connection between mobile client and remote storage server, our proposed method will select another TCP connection opened for data transmission to prevent the congestion window from being divided by two.

The rest of this paper is organized as follows. In section 2, we describe file I/O based remote storage system because our iSCSI based remote storage system is block I/O based, so to turn out the motivation of our paper it is necessary to discuss about file I/O based remote storage system. In section 3 we describe the problems of wireless connected remote storage system. We describe the details of our proposed solution, which consists of parameter collector and TCP Multi-Connections controller and Q-Chain Cluster load balancer. Section 5 presents the results and analysis of several experiments. We conclude with a summary and discuss our future plan in section 6.

2 Backgrounds

2.1 A Remote Storage System

Remote Storage System means the system that multiple clients share and access data on a remote storage server as if its own storage. The CIFS (Common Internet File System) and the NFS (Network File System) are widely used technologies in the area of remote storage system. The CIFS is the extended version of SMB (Server Message Block) protocol that can provide the file sharing function among hosts over the Internet. In CIFS protocol, client program requests file access to a host such as server computer. Server computer provides an appropriate file or answer to an each client in responses to client's requests. The CIFS not only support basic operations of SMB protocol but also provides functions of locking mechanism in the file sharing.

The NFS is one of the most famous file sharing protocol in Unix System environment. Since multiple workstations in the NFS are operated as one single system through network, clients on the workstations can share heterogeneous file systems without regard to the kind of computer server or computer architecture that has large volume capacity. Clients use not only their local file system but also other host's local file system as if their own local file system. Any user who wants to search, store, and modify files of other remote hosts just access or share files through the NFS.