# Adaptation Mechanism of iSCSI Protocol for NAS Storage Solution in Wireless Environment*

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**Abstract.** The continued growth of both mobile appliances and wireless Internet technologies is bringing a new telecommunication revolution and it has extended the demand of various services with mobile appliances. However, in wireless environment the availability of mass storage is limited due to their limited size and weight. Although the problem can be alleviated by iSCSI (Internet Small Computer Interface) based Network Storage System, it has drawbacks in high availability and performance. To address this issue, this paper presents an architecture to adapt iSCSI protocol with traditional NAS (Network Attached Storage) cluster system with an error recovery method. To realize the access to a NAS storage system, our experiments suggest the optimal values for various parameters. The test cases show that the best values of the parameters are not always the default values specified in the iSCSI standard.

**Keywords:** iSCSI Protocol, Network Storage, wireless network.

## 1 Introduction

A NAS (Network Attached Storage) system is a specially designed device providing clients with files on a LAN. NAS has many advantages, such as sharing files in a hetero-architecture, making full use of the existing LAN architecture, easy installation, operation and management, PNP, good connection compatibility and network adaptation, low costs and so on. However, NAS supports only file I/O protocol, such as NFS and CIFS, block-level storage applications are not available on NAS. The performance of NFS and CIFS is only a fraction of the exported storage system due to their single server design, which binds one network endpoint to all files in a file system.

iSCSI is an Internet Protocol-based storage standard for linking data storage facilities, and presents storage to servers as disk targets [1] which appears to be storage attached locally to the server. iSCSI works better than NAS for most

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applications because it provides the illusion that the networked storage being used by the server is exclusive. Whereas, CIFS or NFS-based network allows simultaneous access from multiple servers. As iSCSI presents storage space as a virtual block-level device, operating systems and applications can put their own file systems on them, which is something not possible with NAS.

In the passage of time, mobile appliances are going to be used in many areas. Due to their mobility, mobile appliances must be small in size and they use flash memory storage. However storage of multimedia data and installation of large software system is still a major challenge [2][3][4][5]. To alleviate the problems as well as to access mass storage we have developed MNAS [6], an iSCSI based NAS Cluster system, for the allocation of a mass storage space to mobile clients through network.

In this paper, we extend our earlier approach and propose the inclusion of error recovery method into the adaptation of iSCSI protocol on traditional NAS system to support block based I/O for mobile appliances. After extensive experiments we suggest optimal values for iSCSI parameters into CDMA network.

To adapt iSCSI in mobile appliances we have to address the obstacles to TCP congestion and iSCSI parameters in Wireless connections. Since the iSCSI PDU is a SCSI transport protocol over TCP/IP [1], the iSCSI Data-In PDUs are passed to the TCP layer. When the iSCSI Data-In PDU size is greater than the MSS (maximum segment size) the PDU will be further fragmented into smaller segments. Generally, the size of iSCSI Data-In PDU is larger than that of MSS. If some segments of an iSCSI Data-In PDU are lost due to high bit error rate, TCP layer would require re-transmitting the segments. The other segments of those parts must wait for being reassembled into an iSCSI Data-In PDU in TCP buffer. It decreases the performance of the system due to the reduction of the available capacity of TCP buffer.

In a wireless network with high bit error rate, more the size of iSCSI PDU is increased by the MRDSL (MaxRecvDataSegmentLength) parameter, more the segments would have to wait due to the loss of some segments of parts of an iSCSI PDU in TCP buffer. The write operation has the same results as the read operation in caused by the parameter for target. A wireless link generally becomes a bottleneck portion in an end-to-end TCP connection because of its narrow bandwidth, as compared to wired links. Thus a TCP sender's congestion controls are apt to be caused by wireless link congestions.

When congestion occurs in wireless links, there are two indications of packet loss, timeout occurring and receipt of duplicate ACKs. Though TCP can reduce the transmission amount of data segments using congestion avoidance mechanism, it still transmits data segments until detecting congestion in wireless network. If the amount of SCSI data payload, which is continuously passed to the TCP layer, is increased by increasing the value of MaxBurstLength for write operation or Number of sectors per command for read operation, and the size of an iSCSI PDU is enlarged by increasing the value of MRDSL, the sender will transmit more segments until recognizing congestion in wireless network. It causes the falling of performance of the iSCSI based mobile applications.

The rest of the paper is organized as follows. Section 2 gives an overview of iSCSI architecture. A brief description of error recovery module for iSCSI protocol is presented in Section 3. Our experimental settings and analysis of results are depicted in Section 4. The experimental analysis of sequence error and connection failure is given in Section 5. Finally, Section 6 draws the conclusion of the paper and outlines our future plan.