

## RAM-DISKIO Mode in iSCSI Target

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**Abstract.** Demand for high performance in storage is increased beyond what iSCSI (Internet Small Computer System Interface) has been providing. RAM-DISKIO guarantees to give high performance in iSCSI because, operations like read, write on RAM-DISK are less costlier in terms of access times than that of Magnetic Disks, ultimately performance gets increased. Additionally, the memory of machine has been augmented from few Mbs to many Gbs, RAM is easily and cheaply available in market rather than SSDs (Solid State Drive). So, aim of the research work is to use the portion of RAM as a block device (disk), to export RAM-DISK from target to initiator as a Virtual SCSI device and to utilize this exported virtual SCSI device for storing data. We have written the device driver to tackle the aim and also tested it using dd, iostat, bonnie++ tools. We have compared results with FILEIO MODE of iSCSI and in each sample tests RAM-DISKIO MODE performed better than FILEIO MODE.

**Keywords:** RAMDISKIO, iSCSI, solid state drive.

### 1. Introduction

There are two milestones need to achieve in the storage systems: firstly it should have high performance and secondly easily available storage. Nowadays, storage systems have tremendous amount of RAM in Gbs and Tbs. However, the cost of SSDs (Solid State Drives) is too higher to afford. Hence, need for high performance in terms of access time without SSDs is the current growing demand in market for temporary storage. RAM-DISKIO mode can provide the promising solution for temporary storage which requires high performance and which are geographically located at different places.

iSCSI is the IP based storage networking standard which facilitates data transfers over LAN (Local Area Network) and WAN (Wide Area Network) by encapsulating SCSI CDB (Command Descriptor Block) in TCP/IP PDU.

SAN (Storage Area Network) allows storage consolidation into remotely connected targets while providing illusion to initiator that disks are connected locally. iSCSI allows reachability of existing applications to local as well as remote storage without modification of existing applications.

### 2. Description of RAM-DISKIO Mode

RAM-DISKIO mode is one of the mode in which iSCSI target can be configured to run. iSCSI system in RAM-DISKIO MODE involves operations at both the sides.

The target side would create on demand RAM-DISK whose size will be confined by size of system's RAM. Target would add this RAM-DISK to iSCSI system so that initiators connected to it can discover, login and use it. Initiator would see the RAM-DISK as Virtual SCSI device which is connected locally to system.

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Now, initiator will discover targets available, login in to it, mount it on the directory and use it as if it is local SCSI device. Access time in RAM-DISKIO is much less than that of FILEIO mode. In FILEIO mode, a file is exported to initiator which sees it as a Virtual SCSI device. In this case, operations such as read, write require movement of R/W heads on magnetic disks; access time is much higher than that of RAM-DISKIO mode.

In this way, we can improve performance and access time by using RAM-DISKIO mode where temporary storage is required.

RAM-DISK provided by RAM-DISKIO can be used as replacement of SSDs for testing purpose. It can be used as system's swap area. Target will provide certain size of RAMDISK and initiator will use it as its swap drive. Virtual machine can be installed on RAM-DISKS instead of installing it on the disk. Graphics and image processing operations involve lots of vector operations which can be done on the RAMDISKs for enhancement of system performance.

### 3. Implementation

UNH-iSCSI is the reference implementation of RFC-3720. UNH-iSCSI can be configured in four different modes like GENERICIO, MEMRYIO, DISKIO, FILEIO etc. This mode of configuration depends upon how the initiator sees the target. If target is configured in DISKIO mode, initiator considers the device as DISK. In the same way, if target is configured in FILEIO mode, initiator considers the device as FILE. The default behavior if UNH-iSCSI target configured in MEMORYIO MODE is different. MEMORYIO MODE is generally used to test that connection between initiator and target is alive.

We have implemented RAMDISKIO mode which is very first implementation in Free and Open Source Software in iSCSI Target Side. We tested RAMDISKIO mode on CentOS 5.3 Linux kernel version 2.6.18-128.el5. RAM-DISK module is the device driver which creates RAM-DISK of specified size.

Implementation includes RAM-DISK device drivers, which creates the RAM-DISK of specified size. It defines the various operations on the RAM-DISKS like read, write, etc.

Low level device handler includes, implementation of SCSI commands which will actually use device driver API's. RAM-DISK device driver interacts with the RAM-DISK using commands provided by Low-Level Device Handler. Please refer Fig. (1). Almost all important SCSI commands are implemented.

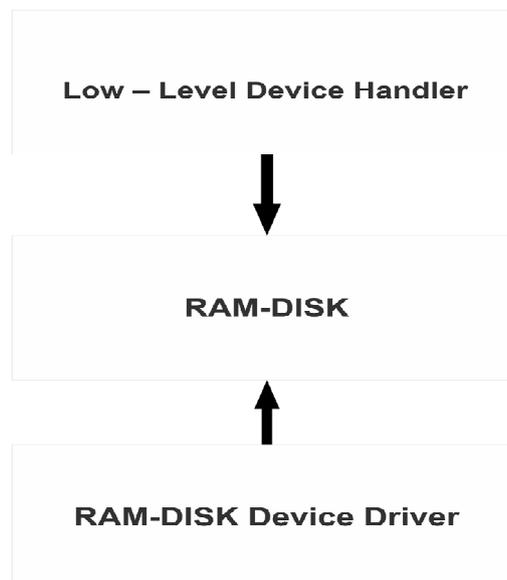


Fig 1: Example

## 4. Performance Analysis

### 4.1. Performance analysis using sequential IO

We have installed UNH-iSCSI target on a machine and openiSCSI initiator on another machine connected over LAN. We have analyzed performance of RAM-DISKIO mode in comparison with FILEIO mode. Fig (2) shows graph of sequential performance analysis. In this case, sequential read and write are tested using dd command. X axis has size of data in Mbs and Y axis has speed in MB/s.

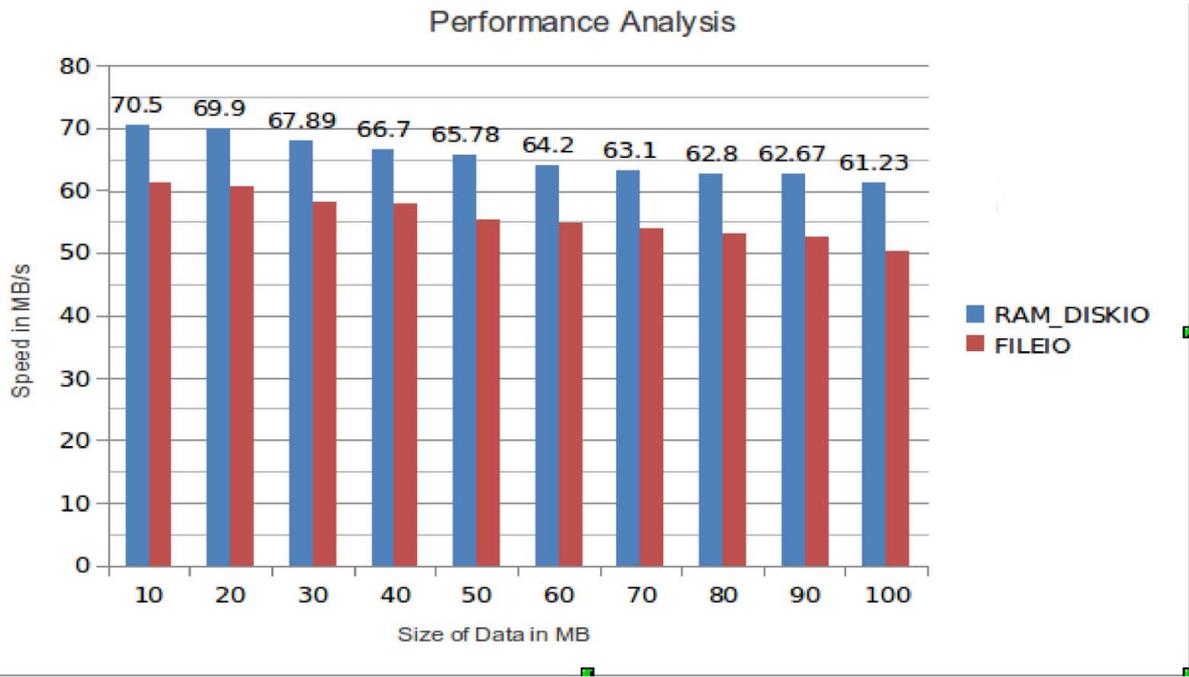


Fig 2: Example

#### 4.2. Performance analysis using random IO

Fig.(3) shows random performance analysis. In this case, random reads, writes are tested on both RAM-DISKIO and FILEIO. X axis has size of data in Mbs and Y axis has speed in KB/s. Tools used for testing include Openiscsi, UNH-iSCSI test suites, lsscsi, dd, iostat, bonnie++ etc. Readings are obtained from bonnie++ tool.

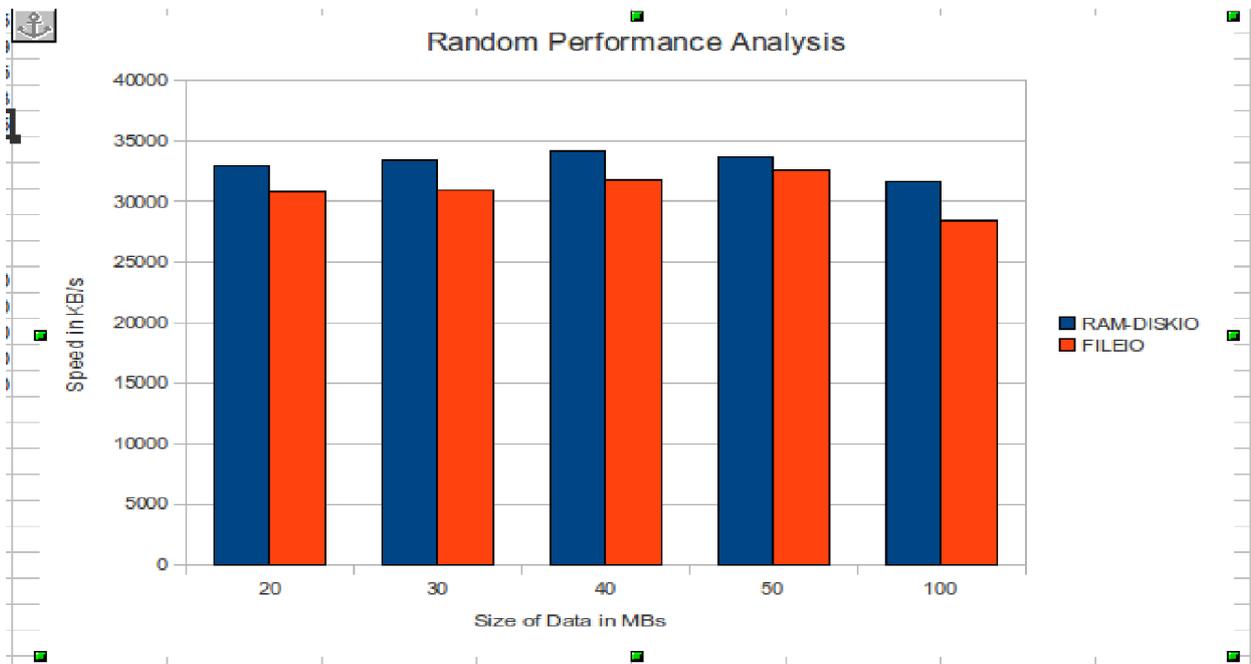


Fig 3: Example

### 5. Use Cases

Following are use cases where RAM-DISKIO can be used.

### **5.1. System's swap area:**

Usually, swap area of the computer resides on disk. It adds the overhead of moving read-write heads while storing temporary data. However, the RAM-DISK created by target machine can be used as swap area of the initiator machine. As transactions occur from RAM, efficacy of transactions increases.

### **5.2. Serving web contents like you-tube videos:**

You-tube has plethora of videos stored on disks. When request is made by viewer to show the video, the intended video is brought into the application's memory. Rather, we recommend that the list of mostly accessed videos should be maintained and the videos should be stored onto the RAMDISK. This can certainly improve the performance of system and user will not get frustrated due to the high access time of the video.

### **5.3. Installing virtual machines on RAM-DISK:**

Virtual machines often configured on the system's disk and they use machine's RAM which makes machine lethargic. Instead, we recommend that we can install virtual machines on RAMDISKs of remote target. Initiator just login to its virtual machine and use it as RAMDISK can be exported to remote initiator. This can alleviate the efficiency problem which confronted while using virtual machine locally.

However, this approach also raises eyebrows as what will happen if target machine gets rebooted while initiator machine is using virtual machine. We can ascertain the data permanency by storing virtual machine files to disk if such catastrophic situations happened. After rebooting the target machine, we can reload the virtual machine files to RAMDISK.

### **5.4. Remote booting:**

We can remote boot the target's RAM-DISK from initiator side. As transactions are from RAM, efficiency gets increased.

### **5.5. RAMDISK as replacement of solid state drives:**

Considering the high cost of SSDs, we can use RAM-DISK for testing purpose instead of actual use of SSD.

## **6. Acknowledgements**

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## **7. References**

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