Short Communication

HYPERDISK, AN ACCESS METHOD FOR REMOTE DISK DEVICES

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A method currently under development for accessing remote IBM-compatible disk devices from IBM-compatible processors is described. The method is transparent to the application programmer and utility user. It provides for data transfer over the Network Systems Corporation HYPERchannel which is the basis of the CSIRONET local computer network.

Keywords and Phrases: remote disks, local computer networks, resource sharing.

CR Category: 4.39.

1. INTRODUCTION

The HYPERdisk project is being undertaken with the co-operation of CSIRO, FACOM Australia Limited, Techway and Storage Technology of Australia. The aim of the project is the development of a method for accessing remote IBM-compatible disk devices from IBM-compatible processors running IBM MVS or FACOM OSIV/F4 operating systems. The initial implementation work is being done on the CSIRONET local network, a description of which is given in Wolfendale (1980), where this project is briefly mentioned (section 5) and further references may be found.

The access to remote disks utilises an Assembler program, referred to as HYPERD, which runs under an IBM MVS or FACOM OSIV/F4 operating system. A minimal hardware configuration for running HYPERD includes an IBM-compatible processor connected via a Network Systems Corporation (NSC) A220 adapter to a HYPERchannel together with an IBM-compatible disk controller and disks connected to the HYPERchannel via an NSC A510 adapter. The HYPERD software is designed to run on multiple hosts attached to a HYPERchannel network so that any host can access any disk which has a controller connected to the network.

Since the initial implementation is being done using a FACOM M190 host processor this description is slanted in terms of the FACOM OSIV/F4 operating system. The primary difference in HYPERD software for IBM MVS systems is due to the fact that IBM channel programs use only real addresses whereas FACOM channel programs allow virtual addresses. This affects some technical details in the analysis of the syntax and semantics of channel programs but does not affect any of the underlying principles.

2. SOFTWARE OUTLINE

The HYPERD software relies on the fact that the FACOM OSIV/F4 (and the IBM MVS) operating system has a Basic I/O Supervisor (BIOS) through which virtually all input/output is done. A feature of BIOS is that it includes only a very small number of machine I/O instructions. This feature is utilised by HYPERD which provides for the interception of all the BIOS I/O instructions.

It is worth noting that NSC has already developed software for accessing non-disk peripherals on the same kind of network (see Hardwick [1980]). The primary difference in philosophy between the approach adopted by NSC and the approach described here is that the NSC non-disk software relies upon I/O interception at a higher level. This necessitates some source level changes to the operating system, whereas the lower level interception method used by HYPERD requires no changes to the operating system beyond HYPERD itself.

HYPERD carries out the following functions.

2.1 HYPERD establishes the primary interception system, initialising the nucleus level code and the run-time data base.

2.2 HYPERD initialises the remote disk tables and tests communications via the HYPERchannel to ensure integrity of the system.

2.3 HYPERD activates primary interception, whereupon remote I/O may commence. The remote devices are established as online to the host processor.

2.4 Once interception is activated all BIOS I/O instructions are trapped. I/O instructions for all devices other than remote disks are performed normally with only minimal overhead. I/O instructions for the remote disks are not executed directly, but rather a secondary task is scheduled which processes the I/O over the HYPERchannel.

2.5 For start-I/O instructions the secondary task analyses the syntax and semantics of the associated channel program. It constructs corresponding channel programs for communication between the host processor and the A220 adapter and between the A510 adapter and the disk controller, and supervises the execution of these new channel programs.

2.6 HYPERD can be stopped at any time, whereafter the remote devices are offline to the host processor.

3. FUNCTIONAL AND PERFORMANCE LIMITATIONS

In principle HYPERD can handle all disk I/O which goes through BIOS. However the NSC A510 adapter[1] has various restrictions on the types of channel programs that it can handle. In particular it cannot handle self-modifying channel programs or channel programs with more than 63 channel command words. Disk channel programs which violate these restrictions will not be executed via HYPERD, but an error will be signalled. There should be minimal impact from these restrictions.

As far as MVS and OSIV/F4 operating system access methods are concerned there is only one method not supported by HYPERD, namely ISAM. This is because ISAM issues self-modifying channel programs. However ISAM is obsolescent, being replaced by VSAM, so inability to support ISAM is not a substantial drawback. All other current access methods are supported.

The current A510 design is such that certain types of channel programs will have their efficiency impacted. For example, the A510 does not support PCI interrupts in the same way as a normal channel. Channel programs for remote disks which use PCI interrupts will have the interrupt presented late. In the context of the MVS and

OSIV/F4 operating systems this does not lead to erroneous results but may reduce efficiency. Also the reading (writing) of adjacent records on a disk via the A510 leads to a lost disk revolution, a situation which will be handled automatically by the disk controller, but with efficiency downgraded.

A census of the day to day traffic on the CSIRONET FACOM M190 reveals that over 80 per cent of disk I/O will not be troubled by inefficiencies due to the current A510 design. Subsequent stages of this project will be directed to software and hardware redesigns for the A510 which will eliminate or minimise efficiency loss.

Running HYPERD on multiple hosts on the same network gives each host access to the networked disks. However HYPERD does not support a management system for orderly access. Multiple access is to be controlled by operational procedures and host-dependent software.

REFERENCES

1. "A510 Adapter Reference Manual", Network Systems Corporation Publication No. 42990006B, 1980.
2. HARDWICK, K. (1980), "Network Input/Output System (NIO) for VM Systems. Preliminary Design Specifications", Network Systems Corporation document.
3. WOLFENDALE, G.L. (1980), "The CSIRONET Local Computer Network", *Austral. Computer J.*, Vol. 12, pp. 85-88.