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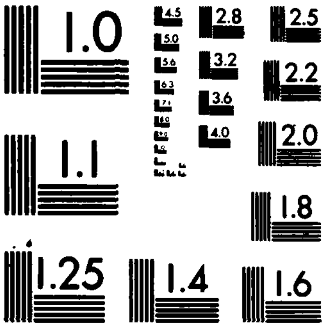

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MEMORANDUM REPORT ARBRL-MR-03333

THE MULTIPLE DEVICE QUEUEING SYSTEM

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February 1984

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Multiple Device Queueing System (MDQS) is designed to provide UNIX with a full function, modular, and consistent queueing system. The MDQS system has been designed with portability, expandability, robustness, and data integrity as key goals. MDQS is designed around a central queue which is managed by a single privileged daemon. Requests, delayed or immediate, are queued by non-privileged programs. Once queued, requests can be listed, modified or deleted. When the requested device or job stream becomes available, the daemon executes

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I. SYSTEM OVERVIEW

Traditionally, UNIX* has been a small system aimed at experienced computer users. The early UNIX queuing systems followed the basic tools concept found throughout UNIX and provided only basic queuing services without any frills. Since then, UNIX has become a widely accepted system servicing a wide range of users and applications. With wider use has come greater demands on the software. The queuing software has been asked to provide the same kinds of services found on "larger" systems. In general, these requests have not been able to be satisfied with the currently released UNIX queuers. The authors, both researchers at the Ballistic Research Laboratory (BRL), have undertaken to develop a general purpose queuing system for UNIX as part of the continuing UNIX development project at BRL.

The Multiple Device Queueing System (MDQS) was designed to fill in the void in the released versions of UNIX caused by the lack of an adequate queuing system. The MDQS is collection of programs that share a common queue management system. There are "enqueuers" that place items in the queue. These are normally programs like **lpr**(1) and **at**(1), but could also be network servers accepting requests from another machine. The "dequeuers" are normally the programs that actually handle output onto the device, but if the device is not resident on the machine, the dequeuer is a network transfer program which will connect to an appropriate server process on a remote machine. The dequeuers are analogous to the UNIX programs **lpd**(8) and **atrun**(8). Queue management programs include the daemon, a status program, and a queue modification program.

II. FEATURES

Lack of a "full function" queuing system for UNIX was a problem: We wanted a number of features that are common to any queued request to be handled by the same mechanism in all cases. These include specification of start time, notice of completion, prioritization, and output limits. We needed the capability for users to list, modify, and delete the queue entries if necessary. The organization of the queues needed to allow for flexible queue administration. It should be possible to have more than one device servicing a single queue and likewise more than one queue should be able to feed a single device. The pairing of devices and queues in MDQS is table driven so that it can be reconfigured by simply editing a file which MDQS reads at runtime (not at compile time!).

*Unix is a trademark of Bell Laboratories

III. CONFIGURABILITY

There are several factors behind the design of the MDQS. The primary design criterion is that the system should be modular. We have the need to queue output to a large number of different devices on different machines. The MDQS will allow requests to be queued on a machine regardless of whether the actual device resides there. We wanted it to be possible to add and delete active queues as the status of hardware and system configurations changed. Lastly, we didn´t want to have a different queuing system to maintain for each device. This means less work for the systems staff and one common interface for the user community to learn. All configuration dependent information is read in at runtime by those MDQS programs that need to know, enabling us to have transportable binaries among homogeneous machines which greatly simplifies queue management.

IV. FUNCTIONAL EXAMPLE

An example of the use of the MDQS will be helpful in showing some of the capabilities of the system. A typical user might start the day by submitting 3 requests to the print queue to be printed on 8x11 paper. He later finds out that the computer room is out of 8x11 paper. One of his printouts is needed for a meeting, so he decides to print it on 15x11 instead. He does a queue status command to find his print requests ids. Using the queue modify command, he changes the forms on his second request to 15x11 and asks that he be notified when the request is completed. Twenty minutes later he receives an electronic message from the queue daemon announcing that his second print request has completed.

Later that day, the user queues 2 "batch" jobs to be run after midnight and again does a queue status command. The two 8x11 prints (id=1,3) are still there, and the new batch jobs (id=4,5) are now also shown. Finally, before he leaves for the night, he decides to start running the first batch job with the hope that it will be done by the time he is finished with dinner. Using the qmodify command he changes the start time of the job to the current time. That evening he logs on to get his mail and finds his first job has completed successfully.

The operators for the system could also issue the commands demonstrated above but if they wanted to access other than their own requests, they would have to specify the user as well as the request id. Operators also need to be able to inform MDQS of changes in the queuing system (e.g., changes in paper type, enabling of a second printer). To make these changes, the operator just edits the MDQS configuration file. The queue daemon detects the changes and modifies its internal tables accordingly.

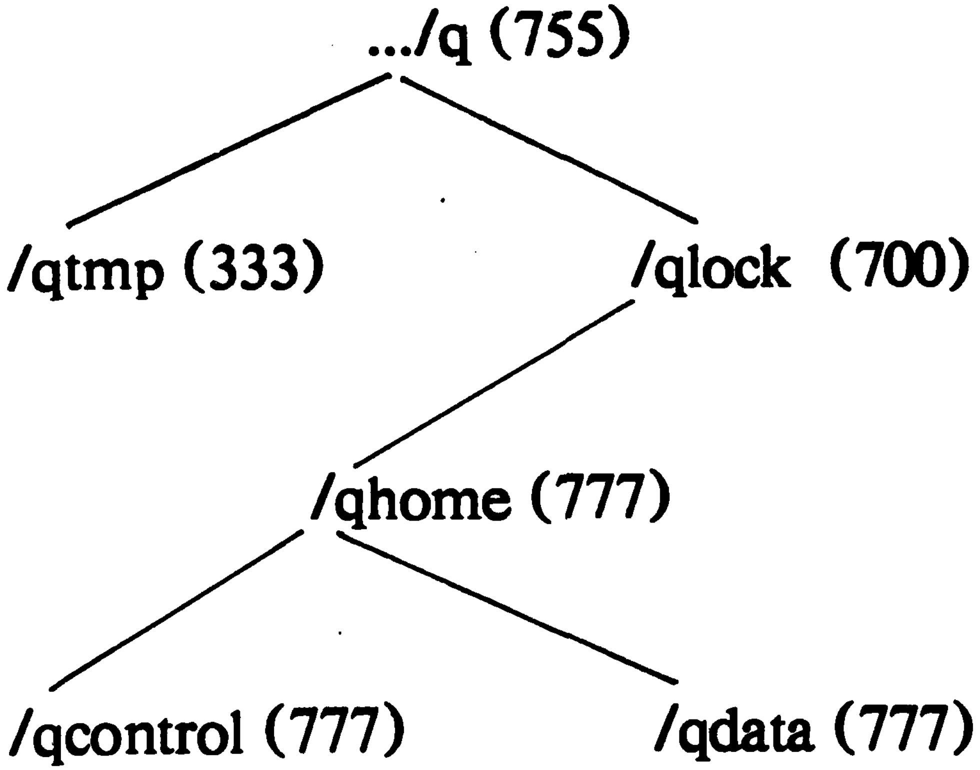

Figure 1: MDQS Directory Hierarchy

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