M.I.T. LABORATORY FOR COMPUTER SCIENCE
Computer Systems Research Division

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# CSR TASK REPORT

by David D. Clark

The attached report covers progress of the Computer Systems Research Division of the Laboratory for Computer Science in the period 1 October to 31 December 1976.

Kernel Design Tasks

I. Multi-Level Traffic Control.

Little progress was made on the implementation of multi-level traffic control, due to lack of time by the relevant people. If practical, we will attempt to continue this project during the spring.

II. Separating the Functions of Page Control and Segment Control.

Drew Mason has almost completed his separation of the functions inside of the Multics virtual memory manager. He has been writing his Master's thesis and expects to submit it within a month. He has identified three principal functions for which the virtual memory manager is responsible: physical management of pages, control of page resources, and supervisor support for segments. By partitioning the virtual memory manager into layers of abstraction, corresponding to the functions, and modeling each layer by type managers, he has a concise structural model of the virtual memory manager. The model presents solutions to several problems, including the quota problem and mutual dependencies between segment control and page control.

III. Study of System Initialization.

Allen Luniewski continued his investigation of system initialization this past quarter. The principal activity this past quarter has been the writing of the thesis report on this research. The thesis will be completed in early January.

IV. Provision of "Breakproof" Environment for User Programming.

During this quarter, Jeff Goldberg wrote the thesis describing his research. The thesis will be submitted in January.

V. Restructuring of Page Control.

During this quarter, an RFC describing Bob Mabee's work on this project was completed. It will be published in January. No further work on this project is intended.

VI. A Case Study of Intermodule Dependencies in a virtual Memory Subsystem.

During this quarter, Doug Hunt finished the writing of his thesis on this project.

VII. Input/Output in a Security Kernel.

Gene Ciccarelli continued to study network-dependence and complexity of multiplexed communication subsystems within the supervisor. Networks and protocols considered include the ARPANET (Host-Host), TCP, Telenet, the proposed LCS network, and terminal

communication subsystems in a secure operating system. The design will remove most network-dependent code from the supervisor, leaving a very simple multiplexing mechanism largely shared between networks.

ARPANET Related Tasks

I. Improvements to Network Mail Facilities.

Little progress was made on this area during the quarter. Charlie Davis was busy with schoolwork and other tasks, so further development of read_mail was inhibited. Some work was done on the preliminary design of a new version which would provide for "context switching", the ability to examine messages in several mailboxes within a single read_mail invocation. In addition, Steve Swernofsky brought Version 4 message segments one step closer to being ready for submission.

II. Modifications to Multics ARPANET Software.

During this period the changes to provide a special Answering Service procedure to handle File Trnasfer Protocol logins was installed at MIT as AS 9.0 and distributed with Multics Release 5.0. Steve Kent started work on changes to allow a previously existing process (normally a daemon process) to service incoming network mail requests; this will eliminate the overhead associated with creating a separate process for each incoming message.

Software to move administrative control of the Multics NCP to ring 1 was submitted to MIT. This will permit the (controlled) use of reserved sockets by unprivileged processes. In addition, control of outgoing Network use can now be restricted on a host-by-host basis. This submission also provides support for Negotiated Options in the Multics Server TELNET -- Suppress-GA is now totally supported, and the Answering Service will attempt to use RCTE (Remote Controlled Transmission and Echoing) to provide password suppression during login.

With the closing of this quarter, no further support of the Multics ARPANET software is planned by CSR, except for training and second level support of IPC and HISI personnel.

III. Development of National Software Works.

Changes to NSW software were primarily internal: MSG was changed to run in a daemon (operator-less) environment; error detection and reporting was improved; administrative procedures were developed to simplify the installation and maintenance of an NSW environment. Such an NSW environment was established on the MIT development Multics machine and now operates as a normal service function. Also, Stan Fleischman (of GSG, Inc.) and Doug Wells created a demonstration system in which the NSW MSG communication system is used to allow a special driver program running on a PDP-10 using the TENEX operating system to update and interrogate a database being managed by the Multics Consistent System.

Research in Distributed Systems

I. LCS Local Network.

Substantial progress was made in the planning of the LCS Network. We have agreed with Prof. Dave Farber to join forces with Farber's group at UC-Irvine in the development of a "Local Network Interface" suitable for use with either the Ring Network or the Ethernet. We will develop an Ethernet transceiver, probably based on one designed at the M.I.T. Artificial Intelligence Laboratory. Current plans call for the initial implementation of a Ring Network, with the PDP-11/70 Unix system and a PDP-11-based GT-40 display system as the first two hosts.

During this quarter a new series of documents, called "Local Network Notes", were introduced. Two major Notes were issued, one by Ken Pogran describing our plans for the Network, and one by Dave Reed describing the Data Stream Protocol which he developed for the Network.

II. Development of Protocol for Local Network.

In this quarter, Dave Reed firmed up the description of DSP (Data Stream Protocol) which he developed over the summer. The description was published as Local Network Note 3.

Dave has made some progress in understanding how TCP and DSP can be unified, through interactions with Vinton Cerf and Bob Kahn, but progress has been impeded severely by the lack of a document describing the current TCP.

Also in this quarter Dave continued working on a service addressing scheme that provides a uniform address space of ascii pathnames for services, and does so in the face of failures of hosts and of parts of the network. This higher level protocol should be described in a Local Network Note to be available early in the next quarter.

III. Study of Objects in Current Systems.

Karen Sollins is exploring the problems of objects in a distributed system. This will involve both the nature of the objects and naming scheme(s). The work in this period consisted of a survey of object (segment) use in Multics. One of the conclusions to be drawn from the Multics experience is that segments and multisegment files are moving in many of the right directions for what users need, but not far enough.

IV. Input/Output Using Multiple Processes on Multics.

Bob Frankston's research this past semester has been concerned with distributed information systems. As part of the planning of the research group's future direction he wrote a an RFC outlining a model for a research vehicle concentrating on the integration of

autonomous computer systems. This is in contrast with the concept of a distributed system growing out of an attempt to take a centralized system and separate its functions into remote modules.

V. Evaluation of Direct Information Sharing on Multics.

Warren Montgomery continued his investigation of direct sharing in Multics during this quarter. An attempt was made to define the measures of sharing that would be most useful in estimating the storage capacity and communication bandwidth needed to provide sharing in a distributed system. The data obtained from measuring sharing in Multics was used to derive estimates of these measurements. An RFC describing the desired measurements and the approximations obtained for Multics will be forthcoming shortly.