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MANAGING MASS STORE FACILITIES: LAWRENCE BERKELEY LABORATORY'S EXPERIENCE WITH THE 7110 AUTOMATED TAPE LIBRARY

J. Michael Long

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Managing Mass Store Facilities

Lawrence Berkeley Laboratory's
Experience with the 7110 Automated Tape Library*

J Michael Long
Lawrence Berkeley Laboratory
University of California
Berkeley, California

August 26, 1980

* This work was supported by the U.S. Department of Energy under contract No. W-7405-ENG-48.

Managing Mass Store Facilities

Lawrence Berkeley Laboratory's
Experience with the 7110 Automated Tape Library*

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August 26, 1980

Lawrence Berkeley Laboratory acquired the Braegen (formerly Cal Comp) 7110 Automated Tape Library as an interim replacement for the IBM 1360 mass storage device. On July 26, 1978 our ATL was delivered. It has a capacity of 2600 slim line tapes and will operate five tape drives. To maximize the capacity and reliability of the ATL, only 6250 BPI tape is allowed in it. Since the device was being installed in a CDC environment, software had to be developed by the LBL Systems Group. The ATL first came on line on March 13, 1979 after about 2-1/2 manyears of programming effort. This initial software was only capable of serial operation, i.e. the ATL had to wait for one operation to complete before beginning another. In this mode the ATL could mount about 50 tapes an hour before reaching saturation. The multiprogrammed version was ready in February of this year and we no longer have saturation problems. This represented another manyear of effort.

In order to enable users of the IBM 1360 to save their data, a system utility had been written to transfer these files to 6250 BPI tape. By the time the ATL was on line, users were already transferring data from the 1360. The ATL system met its design goals and has been in operation nearly 18

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months. The 1360 is now a dim memory and users had ample time to transfer their files before it was shut off.

The ATL has had a significant effect on our operation, most of which was good. Tape mount time, measured from user request to drive ready, has decreased by a factor of three. Recently the median mount time has been less than one minute. The ATL currently mounts nearly 15,000 reels per month. Tape mount errors have been practically eliminated. Internal label checks are made upon mounting every tape. Write permission is checked before any tape is written on so that overwritten tapes are a thing of the past for users of the ATL. When the ATL was acquired, most of our tape mounts were seven track; now 80% of our tape mounts are 9 track 6250 BPI. We are experiencing read errors (recovered and unrecovered) on less than 0.4% of our 6250 BPI tape mounts and write errors on less than 3%. Most of the errors are identifiable, i.e. users specifying the wrong mode or hardware failure; very little manpower is spent on tape error analysis. We have decreased the number of operators by five (through attrition) and people who used to worry about tape errors are now busy doing other things. The more efficient utilization of personnel is, I feel, the most significant effect that the ATL has had on operations. It was not uncommon to be backlogged on tape mounts for several hours after a system crash that caused loss of disk files. Now the ATL handles most of these tape mounts, freeing the operator to concentrate on console operation. Recovery is now a much less frenetic activity and tape backlogs rarely last more than 15 minutes.

These benefits were not derived without expending considerable effort. In addition to the 3-1/2 manyears of systems work, operations spent about one

many years in operator training and documentation. One senior operator was given responsibility to become an expert on the ATL and then conduct training classes. She worked closely with the ATL engineers during acceptance testing and became familiar with the equipment. Hands on training was conducted on each shift and videotapes were made for reference. During this period the central computer code was refined to improve the operator commands. All central code (the operator interface) was written by an operations' programmer. We eventually ended up with a 35 page operator manual and a 5 page glossary of terms peculiar to the ATL. It took about six months to complete this effort.

Mechanical devices are prone to failure and the ATL is no exception. The diagnostics that Cal Comp developed were meant to be run from an IBM system--their stand-alone diagnostics were barely adequate. The LBL systems staff wrote an arm exercisor for the acceptance test and it is now our best diagnostic tool. The ATL requires three hours a week for preventive maintenance; remedial maintenance is about double this. We recently experienced a mean time to failure of 4.2 days and a mean time to repair of 3.3 hours. Unfortunately most of the failure occurs during peak activity so that availability to the user is not as high as the downtime statistics might indicate. Operators soon became adept at operating the ATL in a manual mode. During PM and when the ATL is down, the operator must enter the ATL to locate tapes that are being requested. This is not as difficult as we had originally anticipated but it is certainly inconvenient, especially for 6' operators. Maps of the physical location of each tape within the ATL are produced at regular intervals and upon demand to aid in this operation.

Overall the ATL project has been a success. Error rates have been significantly reduced and users are getting better service. Continued successful operation of the ATL will, however, require constant attention on the part of the operations staff. Error logs must be monitored daily to assure that proper maintenance is being performed and periodic meetings held to review performance statistics. The effort has been well worth it, however, and the total manpower needed to run our tape system is considerably less than in the past. Lastly, the job of console operator has become enriched by a significant reduction of the monotonous task of mounting tapes.

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