About Cal TSS

Cal TSS is a project that was started in August 1968. It initially consisted of 4 programmers from the Computer Center staff advised by Dr. Lampson from the Computer Science Department. From Summer 1969 to Summer 1970, it was under the direction of Jim Gray of the Computer Science Department and consisted of about 6 programmers. It is now under the direction of Howard Sturgis of the Computer Center and consists of 7 half-time system programmers from the Center. There are also about 4 other programmers developing software for the system under Jim Morris of the Computer Science Department.

What follows is a brief description of the System, how it is expected to be used, the current capabilities of the system, and what is expected in the near future.

The basic entity in the system is the file. A file is a sequence of data words, and can contain source programs, object programs, or the data for object programs to manipulate. Files are referred to by name. Programs are available in the system for editing source program files, for compiling these files into object program files and then executing them with data files. Each of these programs in the system is itself a file.

The typical method for using this initial system is to construct a source file containing the desired program. Such a source file is first written and then later modified by using the editor, a program which interacts with the user at his teletype, allowing him to inspect portions of his program and to modify them as he desires. The file containing the user's source program can then be fed to one of a number of compilers that are available, e.g., Cal SNOBOL 4, CDC RUN-FORTRAN, CDC Compass Assembler, and BCPL. Since the Time-Sharing system has a program that simulates the SCOPE system, most of the compilers available under SCOPE on the 6400 can be used under TSS. Once the user has his object program as a file, he can then run it. Using routines that are available, this program can interact with the user at his teletype. Another method of using the system is provided under BASIC, an interactive incremental compiler, which allows the user to interact with the compiler while writing his program. He can execute it for short periods, modify the program, and then continue execution.

Yet another method will be the running of the small batch jobs from a card reader. This facility will make use of the SCOPE simulator mentioned above; for a certain subset of the jobs run on the A machine, it will look exactly like the A machine.

The system itself was designed to be implemented in 3 layers: the ECS system, the Disk system and the command processor.

In Summer 1969, the basic components of the ECS system and a temporary command processor called the Bead had been completed. We were able to demonstrate the simultaneous use of 2 teletypes to compile FORTRAN programs. From then on, the implementation of the system was carried on under the system itself.

Since 1969 this temporary system has been improved in various ways, and is now capable of supporting from 4 to 6 simultaneous users. The system now has about 20 users, most of whom are either developing the system or software for the system.

As an experiment, in the Fall of 1970, 8 students from an elementary programming class were allowed the use of the system for one hour a day, 5 days a week. In these 5 weekly hours the 8 students were able to do the weeks assigned programs, usually with time to spare. The 8 students placed so little load on the system that it is suspected we could have handled 16 students.

The limitations of this temporary system stem from the fact that if a program is manipulating a file, the entire file must reside in ECS. Thus ECS rapidly fills up as more users attempt to use the system simultaneously. Other limitations are: the Bead command processor provides no protection between users, any user may access and modify any other user's files; no accounting information is collected; finally, there is no facility for forcing large programs to reside on the disk part of the time.

As a first step toward removing these limitations, we expect to bring up the disk system layer and a new command processor in early 1971 (January ?). This system will provide protection between users and allow those portions of a file not being manipulated to reside on the disk. We feel that this will substantially increase the number of simultaneous users we can support. Shortly thereafter (1 month ?) we hope to have running a system for collecting accounting information, so that users may be charged. The major drawback of this early 1971 system is expected to be the absence of a facility to force large programs to swap to the disk. Another drawback will be the small size of the disk, resulting in the inability to have large permanent files.

By Summer of 1971, we expect to add the feature which will force large programs to swap to the disk, which will again increase the number of simultaneous users. At this point the only limiting factor restricting the number of simultaneous users should be CPU time. Also, by that time, we hope to have facilities for moving files by name between the disk and back-up storage.

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