USA 1969

PRINCETON

The University is in the centre of the town, consists of a considerable number of Cambridge-style buildings The conference itself was very good indeed, particularly the section on System Design and the avoidance of pitfalls. There was also considerable interest in the problems of measuring and simulating systems: the correctness of the model, the relevance of results. The discussions after the sessions had to be foreshortened for me as my motel was approximately three miles away. Everyone else stayed in the Nassau Inn, or the Princeton Inn, both close at hand. It was interesting to note that at last some measurements are being done on the B5500 internal workings

PHILADELPHIA

My stay here was highlighted by two visits to the British Consol, who kindly invited me for a drink and supper. My hotel was one of the worst places I have ever had the misfortune to occupy: plaster falling off the walls, thick layers of dirt everywhere, water oozing from the bathroom wall, and a smell of rotting material. I trust that this place will not be used again. It is in a rough part of the town, and both the Consol and Burroughs expressed surprise at my being in it at all. The visit to Paoli was very instructive (see attached sheet). The works are situated just the other side of Valley Forge, and are in the process of expanding. Everyone I met seemed dedicated to the Burroughs Machine Design and contemptuous (and ignorant) of any other. All their past problems are blamed on the inability of their sales staff. B5500's are still being made and sold. They are very proud of their banking coup in this country.

WASHINGTON

I was able to see quite a lot of the city during my stay with JCB. The University is quite large, but consists of rather ugly buildings surrounded by roadworks. The computer block has an 1108 running under EXEC 8, with turn-around at best 4 hours. Programmers are kept well away from the machine. They have some form of multi-access, but this is on only for a short time each day, has no permanent disc/drum space available, and seriously downgrades batch throughput. It is used mainly by students.

The visit to NBS is reported in the attached sheet. The site is quite pleasant, but housing is fast catching up with it. The place gave the impression of taking on too many individual projects without great depth.

R E Thomas
Atlas Computer Laboratory
30 October 1969

B8500 Burroughs Paoli 1969

F. Loomis
R. Merrell

There have been 3 goals in designing this machine, aiming at three types of user:

(1) Fast Arithmetic Unit

Comparable with CDC 6600, for such compute-bound jobs as Atomic Energy.

(2) Business Use

aimed at COBOL users.

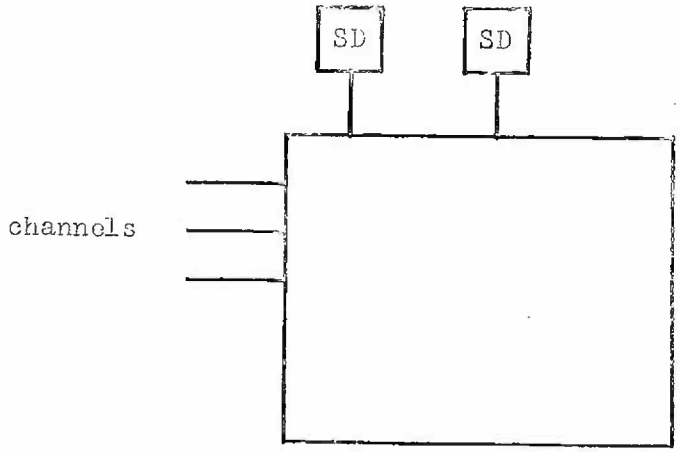
(3) Evaluation techniques

for jobs previously done by interpreters, such as the TRAC language.

One of the essential design features is variable word size. 1 bit is the basic building block, and store addresses consist of (start bit, length) pairs. Variable precision is assigned at run time, an assignment statement generating an item of minimum necessary length.

Declarations of variables may thus appear, or not, at the user's discretion.

All resources are decentralised, a resource allocation being made at each process level. This enables a programmer to supply software to drive special I/O devices without any basic system change. The user may request resources (eg time, space etc) but his utilisation of them is monitored to prevent his tying up sections of the system unnecessarily.



The machine has an 8 megacycle clock, and can take up to 16 modules of 64K "words", 500 ns access. Each word is 64 bits of information + 7 bits for 1 bit correction code. ["words" here are for convenience only, the memory bus and the processor bus are 64 bits wide.] If a unit of information requested by a processor is over a module boundary, 2 cycles are required for the complete fetch.

There are 16 channels connected across the switch matrix. There can be hooked to any combination of

processors
I/O modules
MEC (bulk core or disc controllers)
MM (?)

However, the smallest viable system will require

2 processors
2 I/O
2 MEC

Intentional redundancy is built into the system so that it need never go down. Memory modules may be switched out with only some degradation.

Bulk core, 1 to 2 μs, can go up to 32 million words, and is used for main core backup. In fact, if necessary, this can be simulated by software on the I/O system (to which discs can also be attached for file handling).

There are 4 levels of memory:

(0) local processor buffers

(1) main memory

(2) Bulk extension

(3) I/O device array.

The MEC (memory extension to core) controller has a 64 bit wide data path, and is capable of handling a steady rate of 14 million bits per sec. It consists of three parts:

(1) MIU

to accept the data input

(2) DSU

to relay data to devices. Onto this section can be hung approx 8 high speed devices, 40 medium and 40 low.

(3) Translator

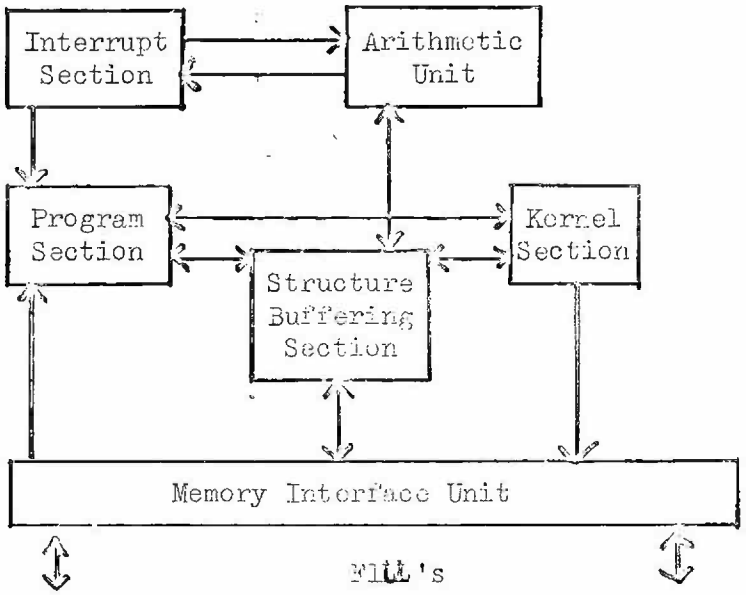
All I/O orders give rise to a descriptor in the job stack, and such an entry raises an interrupt line for the MEC. The translator obeys the descriptor, including any error action requested. If this includes retries, the main processor is not invoked (shades of CDC peripheral processors?).

The Processor

On the B5500, it was possible to perform partial word orders (ie referencing bits in sections of a word). This was done by a barrel-switch technique, as was shifting (ie filling a matrix by

columns and reading by rows to get all permutations of a word). Monitoring showed that 30% of the accesses were for partial words, and that there was not very much arithmetic usage - far less than expected even on so-called computer-bound jobs. Both B5500 and B6500 went to great lengths to fit the desired program code - the B8500 tries to extend this to likely data types

Interpreter Unit



The Kernel deals with address preparation, and can take 9 primitive types, as well as combinations.

(1) Vector (field consisting of fixed-length elements)
(2) Field
(3) Variable Field
(4) List
(5) Queue
(6) Variable Queue
(7) Stack
(8) Push-down (variable size entries stack)
(9) Stack vector (combination of stack and vector)

[possible (10) Deferred structure, type of indirect reference]

Thus, eg, the B5500 stack is a Push-down Vector. Most operations are performed on the data types by hardware (a matrix arithmetic unit can be included). The kernel automatically detects the type and performs the correct access, and the corresponding arithmetic function is also performed. Any requests for traps etc come in the resource allocation request by the user. It was found, however, that variable size lists had to be done by software.

To start a process, we need

Resource stack
Process stack
Name stack (fixed length)
Variable stack

Because the name stack is fixed length, laterals have to be stored in the variable stack, with a name entry in the name stack. It is possible to have a name in store and its associated variable on disc. In fact, the variable length feature can lead to a considerable amount of work by the hardware (which should be, however, faster than any comparable method elsewhere).

Availability

Originally, a B8501 was designed and built (there are two in existence). However, it was found that time-sharing was extremely difficult on them and the hardware was suspect, so they were withdrawn (1967) and the current design started. The B8502 will not be announced until the operating system is working. Currently sections have been built and are being tested. No documentation can be released until the Patent has been obtained, hopefully April 1970.

R.E. Thomas
Atlas Computer Laboratory
30 October 1969

NBS 1969

C Meadow
S Tauber

The department consists of approximately 150 people, of which 30 are programmers. The main job of this group is to advise government and business concerns in the fields of system analysis and evaluation. However, they do work on their own projects, in twos and threes. One such project is the creation of an Information System Generator which can be used by a group to store the design of a project, right from the initial general specification of a manager down to the detailed specifications of individual subroutines. Automatic checks would be included to prevent these details infringing any previous spec. This particular project has still a long way to go.

The programmers have access to an 1108 running under Exec 2 in NBS, but only as another service customer with no extra privileges. As most of their work requires large amounts of output and little computation, this is not ideal. They also have time on a time-sharing system. At the moment they are negotiating to get their own time-sharing equipment (of PDP10 size) in competition to a similar request by the Chemical department. This could come from NASA (free) in 1970, or from elsewhere in 1971 at the earliest.

Special machines on site include MOBIDIC, an old computer used mainly by Engineers, with a large variety of peripherals attached. Languages include BASIC and L6, but not FORTRAN, COBOL etc. There is also a large display (MAGIC II) with its own small computer which can be attached to MOBIDIC, but there seems to be very little software effort connected with this.

Meadow was particularly interested in arranging an exchange of personnel with Atlas, and even in having a one-way transfer in either direction. Anybody going to NBS would be able to do his own work, or join a group, given the limited computer facilities available.

R E Thomas
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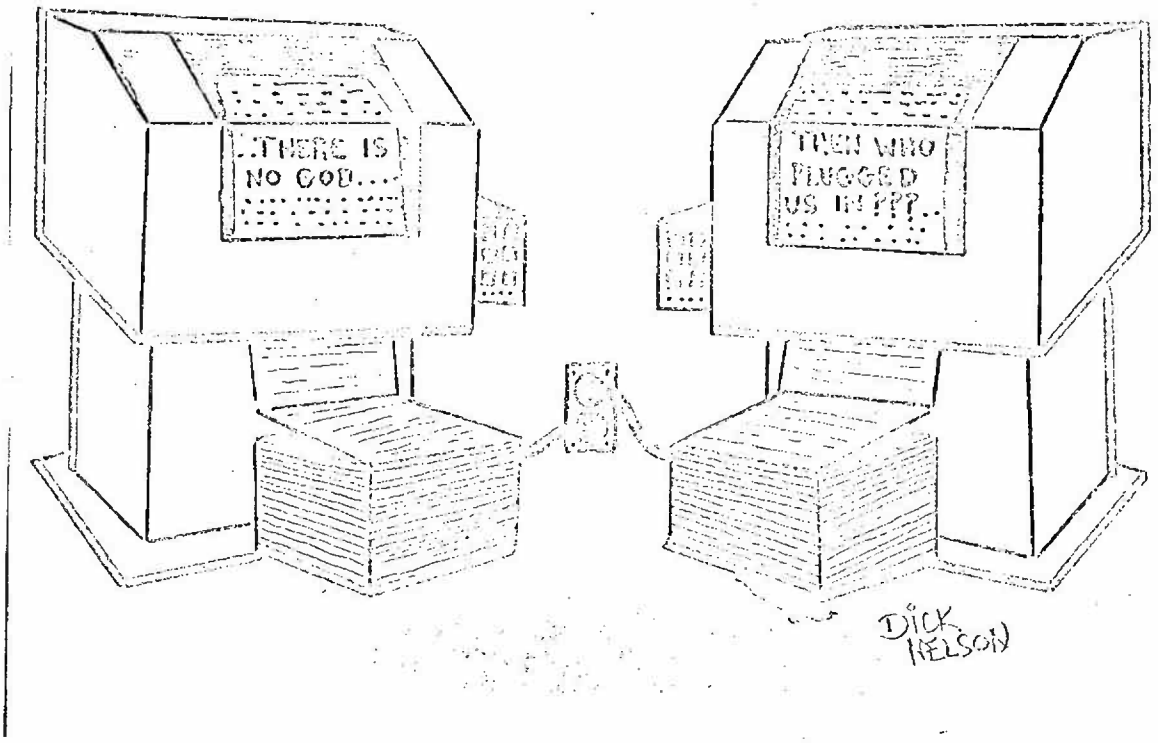
30 October 1969


THERE IS NO GOD...
THEN WHO PLUGGED US IN???
DICK NELSON