

SCIENCE AND ENGINEERING RESEARCH COUNCIL
RUTHERFORD APPLETON LABORATORY

COMPUTING DIVISION

DISTRIBUTED INTERACTIVE COMPUTING NOTE 714

issued by
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Trip Report - L O Ford & E V C Fielding
America 30.9.82 - 15.10.82

5 November 1982

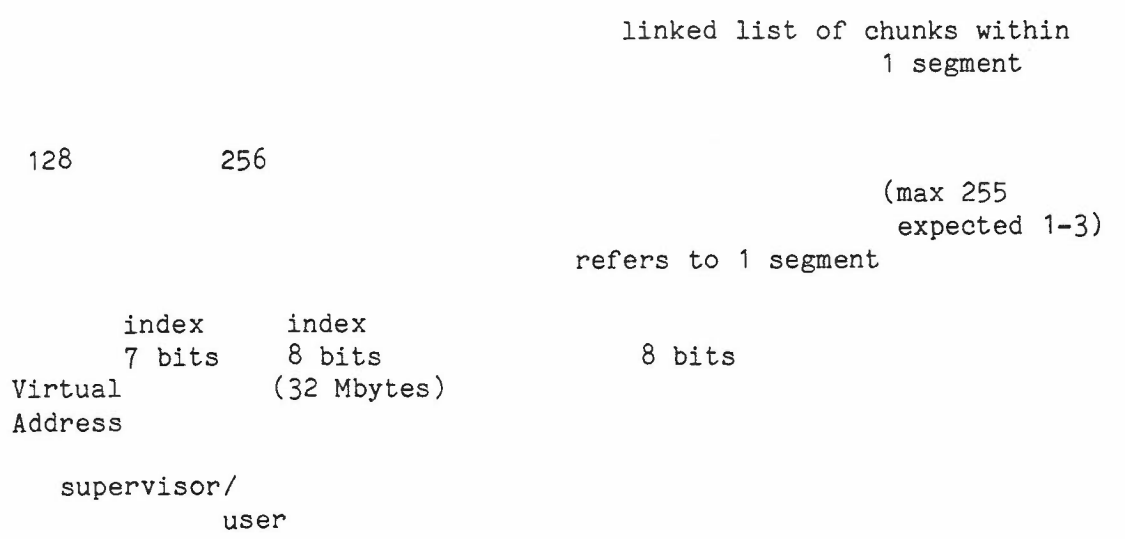
DISTRIBUTION: R W Witty
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1.10.82 Work

- (1) Organised a Perq in the Spice Rack.
- (2) Read first of our tapes into the Vax and tidied up the directories we had left on the VAX. (Had some tape read errors).
- (3) Chatted to Rick about the present state of Accent and where to find the current files.

Changes to Accent

Rick found that the iterative rewrite of the binary tree handling routines did not give the performance improvement he expected. (Approx a factor of 2). He therefore decided to change the SCD data structure from a binary tree to the following:



The advantages he sees of this new structure are:

- (a) All iterative
- (b) Only 2 levels of indirection to find chunks for a segment rather than a nlogn search of a binary tree.
- (c) Validation of a whole segment is fast, i.e. setting 1 bit.
- (d) Invalidation of whole address space is fast as only a single pointer needs to be reset.
- (e) Forking is now much faster as more lazy evaluation.
- (f) More potential for microcoding.

NB. We will get more precise details later.

We're told that people were using the new real microcode to do FFT's. Rick seemed impressed with Bert's code.

Interesting Information

- (1) 40 people mainly in engineering have been sacked at 3RCC (heard from Rick and confirmed by Ray Jones? (of ICL)).
- (2) Solar is due for a release mid November, includes canvas!! (Rick says that this seems impossible).
- (3) Ray Jones? of ICL who was due to stay until February has been recalled immediately because Wilmot has decreed that ICL must become independent of 3RCC for hardware developments. He was working on TKUP (the mini-perq) which has been cancelled due to lack of money. He did not seem to think that this was a bad thing as the performance was the same as the existing Perq and therefore difficult to market.
- (4) Ray Jones? did not think that ICL would take over 3RCC as they had paid them 1M (£ or \$'s??) in advance royalties and 3RCC have sold 3M (£ or \$'s??) of stock (shares or hardware?).
- (5) RIDC is moving back to Gros Street.
- (6) Peter Hibbard seems as busy as ever even though he is on a years leave of absence. He has got rid of his teaching commitments but has kept the rest. The excuse for the years leave of absence is to manage the Spice Project.

2.10.82 Work

- (1) Read everything we would off our tapes and almost everything we needed. Could not read the floating point test but got everything else we needed (we think?). Wrote small program to add 0.1 + 0.5 and it seemed to work.
- (2) Shipped latest Accent binaries to the Perq and shipped Unix binaries. Both Accent and Unix worked. (N.B. this version of Accent has the latest floating point and bug fixed but not the latest data structures or their latest loader).
- (3) Gave up shipping our sources when ethernet became too congested at 6.00 p.m.

Interesting Information

John Martin is working on adding the primitives for regions on the screen. He is also improving the system call interface so certain kinds of ports will be handled as requests on servers.

3.10.82 Work

- (1) Shipped all the sources of Unix plus the appropriate intermediate files to the Perq.
- (2) Shipped sources of Accent Servers to the Perq.
- (3) Built versions of Ld and PccPass2 for both Accent and Pos.
- (4) Put all intermediate files through PccPass2 and Ld.
- (5) Produced listing of our latest code.

Disk problems on the Perq caused us concern and we are contemplating moving to a new Perq.

4.10.82 Work

- (1) Tested commands which had been built the previous day.
- (2) Installed my latest copy of exec with the mapping code in. This caused problems as CMU are still running with a PASCAL compiler with LDDC qcodes crossing page boundaries. We installed our Pascal compiler in place of the standard CMU one. Fixed case in exec if module and import table in exec file crossed a segment boundary.
- (3) We saw a demonstration of the PASCAL source level debugger which runs on top of mace. This is being debugged.
- (4) Collected timings for the various stages of exec running on top of the current version of Accent. Showed them to Rick who showed great interest and started to poke around while exec was running to determine the percentage time spent in the various operations in the system. It appears that one-third of the time is spent in sending messages, one-third in mapping operations and one-third in our code!!
- (5) Showed the 132 bug to Rick. He wants to get more information as he was not able to find what caused it.
- (6) Tried to compile and load the FORTRAN demo (the one with graphics which initialises a square array) entirely on top of Accent.
- (7) Shipped all our loader output and binaries back to the Vax.

5.10.82. Work

- (a) Continued trying to load FORTRAN demo program. Gave up when we hit a 106 error in the linker. Rick is not sure whether we have a version of the Accent boot files with the cross-segment bug fixed. One problem we have encountered running LD under Unix is that as search paths are not supported all Pascal modules such as READER, WRITER, TYPESCRIPT, STREAM have to be loaded explicitly. We must investigate building a PASCAL library.
- (b) Decided to rebuild Accent from sources as this would save time when we return to England.
- (c) Compiled server sources to segs and built system.1.run.
- (d) Shipped sources for Accent.
- (e) Shipped and built PASMACH, having had trouble finding the correct version.
- (f) Ran Accent sources through PASMACH.
- (g) Fixed bug in termdriver. Multiple C's could cause the circular buffer to be continually obeyed.
- (h) Tried a simple C program with reals and got floating point exception.

6.10.82 Interesting Points

- (a) Chatted to Rick about Berkeley's 4.2 BSD.

Rick provided us with a document describing the new features. He commented that the document did not provide enough detail on certain points, particularly with regard to the new IPC facility. When Rick took this point up at the last management meeting, he was told that it was vague because the code had not been written yet. The -release is due at the end of October and the full release January 83. However, Rick does not see how these targets will be met if the code is not written yet. There is no further documentation due until the -release and Rick believed that the code will be the best documentation! The document was primarily written by Bill Joy at SUN even though it is labelled as coming from Berkeley. Both SUN and HP are expected to support a version of Berkeley 4.2

The major item in 4.2 is the IPC mechanism which will form the basis of a distributed system. Rick has had a major part in specifying the IPC mechanism, though he believes the final version is not clean as it has to live with the warts of Unix. Pipes are implemented as a subset of the IPC mechanism.

Work

- (a) Compiled pascal versions of Accent to form segs.~
- (b) Built Makevmboot.
- (c) Shipped microcode binary files.
- (d) Built new Accent boot file.
- (e) Tested version of boot file made.
- (f) Code added to Accent (in Perqdisk and vmpv) to identify where 132 errors coming from. Accent boot remade.
- (g) Added code to Msgerror in Oboe to fault into Mace if a GR greater than 1000 seen. When such an error occurred it was in Uclose and it appeared that the value returned in GR was the address on the stack of the true GR. However, it was not possible to decide if the GR was from the Send or the Receive in UClose.
- (h) Exec code changed to open file first and then do the systat using the file description rather than the filename as before. The timings for an exec call did not change significantly after this change was made.
- (i) A bug was fixed in exec so that spaces are now included in the command line sent to Registrar.
- (j) Tried floating point test in C:
a = 0.1
b = 5.0
c = (a + b) x 10.0
i = c ; printf (i)
produced i = 0 not 51 as expected.

7.10.82 Work

- (a) Added traps to send and Receive in Iacccall in Oboe to halt at first opportunity if we receive a bad GR. Have not seen a single bad GR since running with this code in !!
- (b) Tried another C floating point test on Colin's suggestion:
a = 0.1
b = 0.5
c = 0.1

if a = c then print equal
if a <= c then print less than or equal
if a >= c then print greater than or equal.

ditto for a & b

In both cases all print statements were executed. Conclusion a=b=c and probably though not proven all one 0!!
- (c) Starting building latest OIL failed as files missing.
- (d) Tried everything possible, such as compiling the C compiler, to force out 132 errors and GR errors. Did not get a single error all day.

Interesting Points

Talked to John Strait about state of RIDC. People, including Brian Rosen, are depressed and do not know where their future lies. As far as I can tell they are no longer concerned with hardware developments. John, who had moved from software development last time we were in Pittsburgh, has moved back onto software developments. He has been put onto a project, a design logic program, in which he has no interest. Don Szelza has been moved onto the Solar project which John thinks he ought to have been put on. Of the four people initially put on to the DL program, one has since resigned and Don has been moved to Solar.

John's hardware monitor works, with one or two minor problems. He has used it to count the frequency of q codes in POS; REFILLOP is the commonest!!

8.10.82 Work

- (a) Got out first 132 error when booting Unix and showed it to Rick. He poked around the system with the low-level Accent debugger and came to the conclusion that what we were seeing was a valid swapoutpage case in which he should not report a error. What he believes is happening is that a valid page has been selected by swapoutpage but before it can actually swap out the page another process invalidates the portion of virtual address space corresponding to that page. His solution to the problem is to remove the Accenterror trap from Vmvp:swapoutpage.
- (b) Built latest OIL editor successfully having talked to Keith Wright to find out what our problems were. Found out we were using an old command file.
- (c) Talked to Gene Ball about integrating the latest loader which will provide a clean user stack for exec to work with.
- (d) Removed trap code from send, thus leaving the code almost as it was before but with a trap in receive. Started getting GR bad returns again. The only conclusions we can come to is that the error is generated by the send as no receive trap was called. We investigated whether the code in send crossed a page boundary and found it was no where near one. We and Rick are puzzled by this. We have put the trap in send back and have not seen the problem since.

Uninteresting Points

- (a) Liz finally got through to Stu Feldman at Bell labs. He said that we were using the latest publicly released version of F77 but if we wrote him a letter he would supply all later updates. He implied that the changes were not major.

- (b) I have still not managed to contact Schryer about the floating point test. He is always in the building but his secretary never knows where.

Interesting Points

- (a) Rick told us that IBM are still talking to CMU about an Accent 68000 machine. They wish to become Industrial Affiliates, however the problem is that they want to become Affiliates for life and neither side knows what that means.
- (b) Visited 3RCC to pick up the latest SIGGRAPH demos. We were told that they were not 100% stable and did crash the PERQ occasionally. The PERQ at SIGGRAPH had a modified prom to make speech better. Our version of the prom will make the voice hoarse.

9.10.82 Work

- (a) Rick supplied us with a version of Accent with the latest VM data structures (the binary Tree replaced with a 2 level structure). This version worked for things like the Pascal compiler and Oil in the POS window. However, Unix would not boot on top. It got through 5 exec's before crashing with a memory fault in switchboard.
- (b) We spent the rest of the day trying to isolate the problem, but with no success. We discovered that part of our fileserver code was being overwritten, manifesting itself as strange procedure names when Mace printed the stack trace. Although the crash only happened in the fifth exec, the fileserver was corrupt by the end of the first exec.

Interesting Points

- (a) Rick informed us that 3RCC had decided that their original release date for Solar was not achievable and had postponed it for 2 weeks. We still did not see how they could make this new date as they had not started work on Accent yet.

10.10.82 Work

- (a) We were having problems on the 9/10/82 with resuming from breakpoints so Rick attempted to fix the problem in the microcode.

- (b) In order to get round the problem with breakpoints we attempted to narrow down the problem by putting traps (reference through a nil pointer) in various points in switchboard, basically around code in switchboard around the AfsRead call in the Open call. However, instead of getting a memory fault in the fifth exec we got spurious exceptions in registrar much earlier.
- (c) Rick supplied us with a supposedly fixed version of the microcode for resuming from breakpoints. He had found that a register was not being restored correctly.
- (d) At the end of the day we were no further forward in isolating the bug in Accent.

Interesting Point

- (a) Showed system to Horst? of Siemens who is an industrial affiliate. He seemed to think that we had done a good job on top of an unstable system. He asked if Unix would be made available to the rest of the Industrial Affiliates.

11.10.82 Work

- (a) Rick spent most of the day in finding the bug in Accent. He narrowed it down by tracing through the virtual memory maps laboriously by hand. In doing so he found that code in the fileserver was being overwritten by files being read in by the fileserver. In the end by adding debugging prints to Accent he was able to find that the cause was usecounts on chunks not being incremented properly on a fork so that one process could invalidate memory in another process.
- (b) We spent a lot of the day trying to test the floating point in C and Fortran by writing a program in Pascal which read and passed floating point numbers and an operator to a C procedure where the operation was performed, the result being printed in Pascal. We tested the Pascal by calling a Pascal procedure to do the operation only to find that real input, output does not work under Unix. The reason we found out was the Pasreal has not been converted for Unix. The program ran perfectly under the Pos window.

12.10.82 Work

- (a) Supplied with a fixed version of Accent early in day. We spent the rest of the day testing it in all ways possible, including trying to port the Berkeley version of LS. Found one bug in the system, echo 'a' echoed ,e all other multi-character strings worked.
- (b) Wrote simple C and Pascal program to see if single character writes to teamdriver failed. These did not fail.

- (c) Used Mace Debugger to trap in suitable point in exec of echo 'a', very difficult to catch in the right place, as when we placed a read of a single char in echo 'a' to stop it at a suitable place it worked!! Proved to Rick that problem was caused by a message with a pointer in pointing to a page boundary and a count of less than 3.
- (d) Talked to Gene about problems we were having with his new loader and found that he had two versions of Spawn, and we were not using the right one in swbboot, and so we're still pulling in all of the system and therefore loading the stack.
- (e) This version of Accent with the new data structures also included changed microcode which had a double cache for general store accesses. Rick believed that this should make C and Fortran programs run faster. He was seeing a 4% increase in the speed of execution of Accent with this microcode. Rick had also changed some of the accesses to his data structures as he had found that the pascal compiler was generating verbose code for accessing records of a single word.

```

type Bit32= record of boolean.
    case false: (lng : long)
        true : (double : array [1..2] of integer)
    end
var i,j: Bit32;
    i:= j; is bad; movewords is used.
    i.lng :=j.lng; is good.

```

Interesting Point

Jon Bentley is going to work for Bell Labs for 1 year.

13.10.82 Work

- (a) Rick fixed bug in echo 'a', was found to be a round on a page boundary which should have been add 3778 and round to next page boundary.
- (b) Set up system on Vax for writing tapes to bring back to England.
- (c) Spent most of day testing new Accent and trying to boot Unix with Gene's new loader. By the end of the day we had tried our first boot of Unix with the new loader only to find that the fileserver (switchboard) would not initialise. This needs further investigation in England.
- (d) Timing tests on the new Accent showed that exec was running 10 to 20% faster after Rick found another bug in invalidate memory. This stage in exec was 5 times longer before the bug was fixed.

- (e) Wrote first tape for England. (1am - 2am on 14.10.82 please note!!).

Interesting Points

- (a) Talked to Scott Fahlman.
- (i) Told us that Lisp was going well, the current problem being that Accent crashes 1 in 100 context switches between Lisp and Accent microcode. They are finding it very difficult to trace this bug. They find Accent very slow.
 - (ii) He did not believe that the Perq would even be a serious AI machine with its low power compared to the Symbolics machine. He believed that it might run a fancy editor!!
 - (iii) Informed us that one problem they were having was lack of documentation on Accent. The Spice project was shrinking fast, Gene Ball is due to leave in January to cofound a CAAD company, leaving only Rick and Peter Hibbard!! (Scott does not count Peter Hibbard), and the main authors were concentrating on coding rather than documentation. We believe that the Spice Project is disintegrating and certainly cannot achieve their grandiose goals with the present manpower. Graduate students cannot make up for the experience lost through George Robertson, Sam Harbison, Mary Thompson and Gene Ball leaving - any work other than Rick's (and Gene for now) is falling on them and even on undergraduates who then flunk out on other disciplines (quote from Scott).

14.10.82 Work

- (a) Spent the day frantically writing tapes and making sure we had the latest sources of everything.

Interesting Points

- (a) Rick is now using Unix as a test tool for Accent. He has installed it on his machine and has shown far more interest in it. Other people are keenly interested in our Unix.
- (b) We have antagonised Rick's wife by keeping him away from home!! We did not get the usual invite for a meal.
- (c) Rick has now finished with performance and will turn his attention to preparing for the Industrial Affiliates. He intends to demonstrate IPC calls between Perqs and the Vax.
- (d) We have left with the latest versions of everything, including a fix for Fortran Paging although not tested.
- (e) The cause of the 42 second pause has been found, an uninitialised variable in clock. (Found by 3RCC on 13.10.82).