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The ANAHL Scientific Computer System Local Area NETWORK

Paper to HP 1000 User Group of Victoria, 11th July, 1984

by Gary Grant

INTRODUCTION

The ANAHL Scientific Computer System is a local area network that is presently very much an "off the shelf application" of existing HP products and technology. At the risk of making this presentation a sales promo for Hewlett-Packard, my real intention is to convey how we have basically unpacked this equipment, read the manuals, plugged everything together, and been able to make use of it all but straight away. Consequently we are still yet to get into the more detailed application of HP's communications products and we may not yet appreciate or be affected by any limitation that others have experienced.

ANAHL

Before describing our NETWORK in some detail a description of the Australian National Animal Health Laboratory and the organisation of its computing resources will probably be of interest.

CSIRO's Australian National Animal Health Laboratory (ANAHL) is a highly secure complex, in which exotic/foreign animal disease causing agents, can be studied without risk to Australia's livestock.

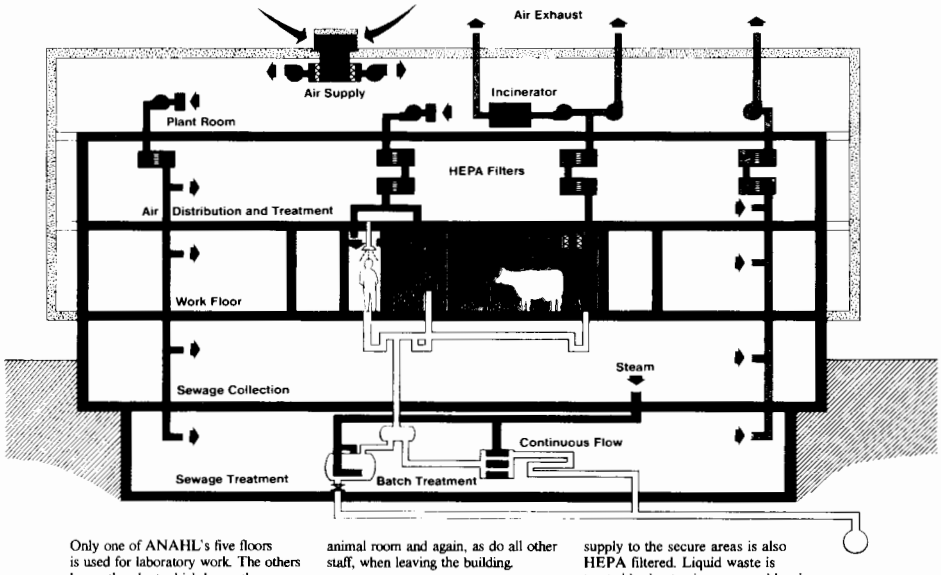
The provision and maintenance of such a secure environment is a complex task. Data Base technology is being used to provide tools for the efficient management of ANAHL's information resources via our NETWORK of HP 1000, computer systems.

The main role of this NETWORK, is to directly support users rather than the pursuit of computer science. The NETWORK is expected to offer facilities for the Scientific, Engineering and Administrative disciplines represented on site. This includes provision of an information management system and resources for real time, data acquisition and instrument control. Users will be supported at a number of points throughout the complex via visual display terminals and standard interface types.

In designing the NETWORK, apart from consideration of the expected users and the type of applications it is to support, much consideration has been given to the physical environment of ANAHL.

The diagram below shows a sectional view of the Laboratory.

Air and Sewage treatment at ANAHL



Only one of ANAHL's five floors is used for laboratory work. The others house the plant which keeps the building secure and operational. The lower four floors are within the airtight secure barrier. Staff working with animals shower when leaving the animal room and again, as do all other staff, when leaving the building.

All air leaving the building passes through two high efficiency (HEPA) filters in succession. Air leaving the areas of highest potential risk can be incinerated after filtration. The air supply to the secure areas is also HEPA filtered. Liquid waste is treated by heat using steam, either in a continuous flow process where it is kept at 99°C for 20 minutes or in a batch system where it is heated to 135°C for up to 2 hours.

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HP Computer Museum
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Structurally the laboratory consists of a nested series of rooms one inside the other, each room operating under a lower air pressure than the surrounding rooms. It has five floors, one of which is the laboratory work area, the other four floors house support plant equipment. The laboratories handling of infective agents are arranged in three physically independent suites, each satisfying a different function.

On the outside of the contained area are the administrative and engineering services buildings. Consequently the following points were particularly significant in the design of the computing system; ease of use and application of computing resources, the decentralisation of the laboratory complex, the total area of the work floors and the physical constraints placed on the movement of personnel, information and equipment through the secure and non-secure areas of the laboratory.

Based on the physical constraints associated with the complex, the expected job mix of the NETWORK and available resources for its development and maintenance, a distributed computing system was selected at ANAHL. This approach is seen to offer maximum flexibility for our laboratory applications, system reconfiguration, hardware back-up user access and maintenance.

THE SCIENTIFIC COMPUTER SYSTEM LOCAL AREA NETWORK (SCS)

The system being developed consists of a NETWORK of six Hewlett-Packard A900's, each with their own 7914 disc drive, printer, plotter, user terminals and ports for Laboratory instrumentation applications.

One A900, from now on referred to as a NODE, will be found in each of the three secure laboratory suites and the Engineering Services Building. Two NODE's are located in the main computer room, situated in the Administration building. Data Bases generally run on local NODE's and access data residing on the ADMIN 1 NODE. All NODE's are presently NETWORKed in a star topology using HP's 12044A DS/1000-IV HDLC direct connect interface's and DS/1000-IV software. All NODE's run under the RTE-A operating system.

THE COMMUNICATIONS SYSTEM:

When the building was constructed, the method adopted for cabling also conformed to the containment standards required. All of our cabling has been built/sealed into the main secure structure.

At that time a fair level of cable redundancy was also incorporated to allow for any future requirements or reconfigurations should they arise.

The Cables servicing the secure/contained laboratory complex are also jelly filled to eliminate the chances of micro-organisms escaping via any gap that may exist between the conductor and the insulation.

We used a locally produced BELDON equivalent cable for DS and standard jelly filled underground telephone cable manufactured to TELECOM specification for remaining applications. The NETWORK's cabling totals approximately 30 km.

So, how do we make use of so much cable, and what sort of distances do we communicate over? Our longest DS run is from the Administration Building to the Engineering Services building, a cable distance of 420 metres. The maximum baud rate of 230Kbs is being used, so far without any problem.

Each NODE has an associated LINK panel, where the enormous number of cables associated with a work area can be patched into the computer room cabling.

For communication between any of our NODEs and its associated peripherals, we are presently using 12040B Multiplexers running at 9600bps. For distances in excess of the RS-232 50 or so foot maximum, we run the entire 8 channels from the NODE, in their combined RS-423 form, up to the LINK panel then across to the work area in question, where Mux panels of our own manufacture redistribute the channels as individual RS-232's.

The LINK panels are of KRONE manufacture and are of the insulation displacement type, making the linking of computer ports to rooms a relatively quick and simple operation.

I suppose we can be described as being reasonably fortunate in being able to make use of this technology at this time. A high percentage of the laboratory equipment now destined for installation in the laboratory has an associated RS-232 port. HP also support any handshake and offer a range of suitable drivers within RTE-A that so far haven't required a great deal of effort in order to make use of them.

For our laboratory instrument applications, we also have equipment that caters for ANALOG devices. This equipment is portable, and can be stationed at the ANALOG device where it merely acts as an A-D translater.

The controller interfaces directly to a MUX channel and ANALOG inputs are poled for data and status using ASCII characters.

This equipment requires current loop cabling which also overcomes the problem of long cable runs.

APPLICATIONS:

We took possession of our first A900 about this time last year. We presently have four of our machines in operation and we are expecting delivery of the remaining two shortly.

Last January, in conjunction with Glenda Patterson from HP, we put together an interesting set of tools which we call our NETWORK RESOURCE SYSTEM.

A technical note describing this system in detail is in the Focus/1000 section.

This system is directed at simplifying the effort required by application programmers and our typical network user in being able to more efficiently utilise the various resources distributed throughout our network.

The results of this work made use of standard HP software features, and on completion of the work we had achieved:-

(i) A set of easy to use programmatic CALLS (NRSFUNCTIONS) that enable an Application Programmer to make easy and efficient use of any RESOURCE on the NETWORK.

(ii) A RESOURCE DEFINITION Data Base whereby any RESOURCE on the NETWORK can be referenced by logical name.

The Data Base provides the ability for mapping RESOURCE NAMES to LOGICAL UNITS and NODES. The Data Base also contains control information on RESOURCE access. "Checks the DB for existence and availability of a Resource. If so, fetches node and Lu."

(iii) A set of CONTROLLERS to supervise and co-ordinate all usage of the system, including cleaning up when programs abort or DS links fail.

(iv) A set of RESOURCE MONITORS that enable an interface between the Application Program and RESOURCES.
"interprets and executes requests from calling application program. It can also return information to calling program and also offers a means of locking remote resources."

(v) Special UTILITIES for controlling and utilising the system.

"Application, DSP, enables user to set up spool file from any node to any resource on Network." Can do a wildcard print.

The essential features provided by the system are:-

(i) Centralised control of RESOURCE access.

(ii) Automatic redirection from an unavailable RESOURCE to an alternative RESOURCE.

(iii) Enable exclusive access to a remote RESOURCE if necessary.

(iv) Resolving the problems associated with the remote locking of a RESOURCE on our NETWORK.

CONCLUSION

Our NETWORK is presently supporting users and several data base applications. We use DS on the present NETWORK every day, and our users find its operation quite transparent.

The NETWORK is ideal for disseminating information around the Laboratory complex. We are presently putting three HP 150 Personal Computers to use in the production of documentation. We make use of DSN/LINK to transfer files from these machines to and from the SCS.

Co-ordinator's Comments

This is the first issue for 1985. The next issue will be March 1985. I will be endeavouring to put out Crosstalk every two months. To assist in this aim a Crosstalk editorial committee has been formed.

This committee consists of Norm Kay from the 1000 Users Group, Chris Simpson from HPDCUCV and myself. The committee was formed with the idea that articles can be collected and the committee can decide if there are enough. If there are not enough articles then the members will shift into high gear and try to drum up some extra articles.

The committee will be meeting in the first week of the even months and Crosstalk will be printed and distributed early in the odd months. The deadline for articles will be the first week of the even months (unless space needs filling).

If it is near or past the deadline still send in your article. It may still make the next issue and if not, then it is early for the one after.

Let's hope we can keep to the schedule and that 1985 can be called a great year for Crosstalk.

— John Green
HP Melbourne

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Hewlett-Packard Sales Re-organisation

HEWLETT-PACKARD has undergone a major re-organisation within its sales districts. Our objective is to provide a better level of support to customers along Market oriented lines.
I would like to take this opportunity to explain to you the reasons why we made this decision and where you could fit into the new structure.

For some time now we have become aware that H.P. was being viewed externally as being a conglomerate of small companies all competing with each other for business. This may imply that the best possible solution to a problem was not being looked for, but rather, that an idea within a sales reps. particular area was being pushed. Whilst I don't believe that has been the case, I am mindful that it could have happened under our previous organisation.

By abolishing the rigidly defined product lines, and dividing the sales districts up into Market oriented groups, we have ensured that:

1. A sales representative will spend all of his time working within the general industry in which you are interested.
2. A clear understanding of the jargon and the problems that each industry group contains will provide the best possible solution to be found in the least possible time.
3. Customers can talk to people interested in their own industry about any of the H.P. solutions or products. No longer will you have to talk to instrument reps., technical reps. and commercial reps. in order to get the answers and support you deserve. Now you will be able to have a central contact point. An account manager that will marshall the appropriate resources within H.P. to solve your problems.

Coinciding with the sales structure changes, the application support specialists have re-organised to provide detailed application support both to the sales districts and to the customers within those districts. Now application specialists will essentially belong within one sales district. This will ensure that they too will develop a clearer understanding of the forces within the businesses they support.

SALES DISTRICTS

1. Information Systems .. Sales D.M. Jeff Herrick
2. Manufacturing ..... Sales D.M. John Antonello
3. Government ..... Sales D.M. Tom Pilcik
4. Major Accounts ..... Sales D.M. Adrian Farrell
5. Distribution ..... Sales D.M. Andre Blom
6. Third Party ..... Sales D.M. Mike Rimer

It is worth noting that Rob Stewart, formerly the D.M. of the technical computer group has left H.P. after a fourteen year career. In his place a number of sales reps. with whom you may be familiar have been promoted to District Managers. They are, Jeff Herrick, Mike Rimer, and Tom Pilcik.

One final point is worth noting. You may have developed a good working relationship with your H.P. sales rep., and so may be dismayed at the prospect of another change. In practice, if you are going to be changing reps., don't worry. It will be a gradual change over the next six months. Furthermore, in most cases, if you are particularly happy with your present rep., it is probable that he will have been moved into the district appropriate to you anyway, so many of you will see no change from that respect.

If you have any enquiries regarding these matters please don't hesitate to call H.P.

Phillip Moon,
Hewlett-Packard

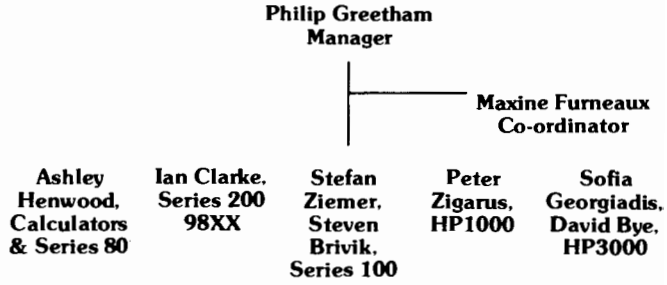
Changing Post-Sales Customer Support

Over the years H.P. has made a number of improvements to enhance our customer support services. 1984 has been no exception as we have seen the beginning of some major changes to the way we provide post-sales customer support.

Until now we have had two distinct groups providing post-sales software. Software support for calculators and P.C.'s has been provided by our "Access Line". At the start of 1984 this consisted of a team of three engineers, Ashley Henwood (calculators & Series 80), Judi Wilkinson (Series 80 and Series 100) and Stefan Ziemer (Series 100). In June Steven Brivik (Series 100 applications) replaced Judi Wilkinson and in August Ian Clarke joined the group and extended our complimentary post-sales support to Series 200 and other BASIC language work-stations.

In addition, support for customers with larger computer systems has been provided to customers with software support agreements by the systems engineering organisation. There are a good number of highly experienced systems engineers, each with their own speciality who have provided the post-sales customer support on a roster basis. With the rapidly-increasing number of computer systems installed it has become increasingly difficult to provide the high-quality customer support demanded by our customers, and of which we can be proud. Our account systems engineers have had to contend with several, often conflicting interests, including account management and customer training.

Against this history, H.P. world-wide has begun to implement a new strategy to provide that support. In this country, the strengths of both of the above-mentioned groups have been combined to form the Australasian Response Centre whose sole function is to provide post-sales telephone support. The new structure will double the number of engineers dedicated to post-sales customer support. The role of the group is to provide systems, sub-systems, and/or applications level support to customers in technical or commercial environments. We have been fortunate in recruiting experienced systems engineers, and this coupled with an aggressive training programme over the coming year and the continuing support and back-up of our account systems engineers, will enable us to provide expert assistance in a more timely manner. The structure of the A.R.C. is now as follows:



Philip Greetham:
12 years experience in industry and education prior to joining H.P. Three years experience as systems engineer.

Maxine Furneaux:
Prior to joining H.P., self employed in secretarial and public-relations for 17 years.

Ashley Henwood:
Service technician for 4 years prior to H.P. Two years experience in calculator service prior to joining "Access Line".

Ian Clarke:
Double-major in computer science and instrumentation. Seven years industrial experience in various sales and service fields.

Steven Brivik:
Electrical engineering graduate and M.B.A. Two years in industry including 18 months with H.P. service administration.

Stefan Ziemer:
Applied Science graduate with one year experience supporting Series 100 on "Access Line". Specialist in MS-DOS and various languages.

Peter Ziguras:
Distinguished academic record in computer science with 3 years experience as systems engineer in pre and post-sales support roles.

Sofia Georgiadis:
Analyst/programmer for 4 years on large H.P. installation plus 3 years experience with other major vendors.

David Bye:
Computer Science graduate with 1 year experience on a large HP3000 installation.

In addition to the above staff, we expect shortly to have a dedicated customer engineer to provide remote hardware diagnostics and preventative maintenance via modems to our HP3000 customers.

To improve the effectiveness and productivity of our staff we are installing a number of software tools and systems. Called "STARS", the first of these such systems installed consists of query programs into a large data-base of known problems on all our computer systems. Our record system which we are just implementing now, is a new system to enable us to track all of your telephone calls and our call-back plus a number of other features. This system developed in the U.S. called TRAK II, is an enhancement over our current tracking programme which was developed in Melbourne. A number of other facilities are proposed including a leased line to the U.S. Response Centres in the U.S. to give on-line access to their expertise systems, information, software patches, etc.

In summary, I believe that the coming year will confirm post-sales support from H.P. to be the best in the industry: that is the goal of each and every one of us in the Response Centre.

Philip Greetham

NEW PRODUCTS

The HP-71 Handheld Computer — Your BASIC Number Cruncher!

The HP-71 Handheld Computer takes over where the HP-41 leaves off. Its 64K-byte enhanced BASIC operating system supports seven file structures and provides high calculation speeds which are further improved by FORTH and assembler capabilities. For interfacing, HP-IL provides data transfer rates up to 5,000 bytes per second. Powerful CALC mode (a non-programmable advanced calculator operating mode), combined with a 10-digit keypad allows not only quick solutions, but fast, easy input of numeric data, too.

The HP-71 has 17.5Kbytes of built-in user memory. Its versatility is enhanced by the four RAM/ROM ports, so you can add any combination of RAM or ROM modules. In fact, a maximum of 256Kbytes of ROM can be used at once — a potential of 273.5Kbytes of memory. And that's an extraordinary amount of power to hold in one hand!

Take advantage of already-tested HP software in a variety of applications. Convenient plug-in modules, mini-data cassettes and magnetic cards are several of the media available to you.

The HP-71 is an "open machine", too. HP has documented the internal specifications, and they are available to you. You can create your own hardware, software, firmware, and interfaces — in fact, you're limited only by your imagination!

And whether you're creating sophisticated programs or crunching numbers, the HP-71 backs you up with the power, accuracy and versatility you demand.

NEW PRODUCTS

HP 7941A and HP 7945A Discs

The HP 7941A and HP 7945A are designed and priced with HP's entry level multi-user system in mind. Each HP 7941A and HP 7945A is based on a plated-media 5¼-inch high-performance disc drive. The formatted capacities of the HP 7941A and HP 7945A are 24 megabytes and 55 megabytes, respectively. Each product also includes a microprocessor-based controller to manage the disc drive and ensure the utmost accuracy of recorded data. Both products come ready to operate, packaged in a compact desktop cabinet.

Features:

- 24 megabytes (formatted) — HP 7941A
- 55 megabytes (formatted) — HP 7945A
- Rugged, sealed head-media design
- 5¼-inch plated media
- 30 ms average seek time
- Automatic error correction
- Rear panel diagnostic access and readout
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- Extensive built-in diagnostics confirm the drive is operational and mean faster repairs should a failure occur.
- Compatibility with existing cartridge subsystems built into HP discs offers data interchange.

DESKTOP FORUM

MULTIPLE NUMBERS

(Numeric Data Packing NDP)

The objective is to store more numeric data without using more bytes. This is possible, under certain circumstances, because simple numerics or numeric arrays require 8 bytes per numeric or numeric array element of storage space. HP-86/87 computers handle 12 digits plus decimal point and plus-sign.

Before an attempt is made to avail oneself of this Numeric Data-Packing (NDP) it is necessary to examine the range of data in question.

Very often the range of the data is restricted, e.g. whole numbers, 8 digits, etc. The simplest case of NDP (Numeric-Data-Packing) is packing of 2 whole numbers by means of presenting one as a decimal of the other. Each number can be identified by the functions IP and FP respectively.

A combination of these two functions enables us to recall or to modify any part of a composite number.

Let us assume that A=210987654321; N is the position of the required digit B.

The following expression will render B:
B=FP(IP(A/10 (N-1))/10)×10.
A = 1P(A/10 N) × 10 N + (FP(A/10 (N−1)) × 10 (N−1) + X × 10 (N−1)
(× is multiplication sign).

This last expression will change progressively the digits to a new value X. To change 1 only digit at a time, the result has to be referred to by another variable, say, C.

The application of the above makes possible, under circumstances, an addition of a new data without extensive modifications of the format of existing data.

Another application lies in an organization of a data base, which makes extraction of relative data much faster.

An example of this are employees data. These may include sex, age group, education group, length of employment, remuneration range, size of the family, travelling distance to work, car type, ownership of electrical appliances, etc., up to 12 different categories. Each category (position of a digit) can be broken up to 9 different values plus 0 which can mean simply a command to disregard the category. Each employee will be assigned a number, reflecting answers to questions in all categories.

To find employees within required categories and ranges one has to create desired range numbers and simply compare them with employee numbers.

H. Drillich,
44 Dempster Ave.,
North Balwyn, 3104.
Phone: (03) 857 6816.

HP85 STRINGS

My 'snippet' concerns itself with string concatenation on the HP85. This is normally achieved with the ampersand, e.g.

A$ = A$ & F$

This works fine when concatenating small strings and where memory utilisation is not a concern. It is important however to realise what the HP 85 BASIC does to perform this operation. When the '&' is used to join strings the 85 first looks for unused RAM (i.e. memory that is not already allocated to program or variables). It then makes a copy of the first string into that unused RAM and then appends the second string to it. The resultant string is then copied back into that part of memory reserved for the first string. This operation, when dealing with large strings, is both inefficient and can quickly lead to the rather confusing error message:- MEMORY OVERFLOW.

For example: I once had the task of extracting information from a data recorder through an RS232 Interface. The RS232 provided on the data recorder used only pin 2 (to transmit data) and pin 7 (for logic ground). No other pins were available (for handshaking) and the recorder transmitted it's entire 24K odd of data non-stop. The tape system of the HP85 was not fast enough to work in 'parallel' without causing an over-run of the Input Buffer. The data then had to be held in memory until the entire transmission was complete. This seemed to be no problem since the HP85 had been upgraded to 32K. All I had to do was dimension a string large enough to hold all the data (plus extra to insert a record separator between each record within the string) and to have an IOBUFFER long enough to hold each record as it was transmitted. I would then read each record as it came in, append a record separator (e.g. a carriage return) and then append that record to the main data string. Once all the data had been sent I could then go back to the main string, break it up into records (looking for the record separator) and then write those records to tape for further processing. Ignoring the RS232 functions, the program looked something like this:

```
    DIM I$[75], B$[26000]
    B$[2], B$ = " "
    SET TIMEOUT 10; 10000
    ON TIMEOUT 10 GOTO 20
10  ENTER 10; I$
    I$ = I$ & CHR$ (13)
    B$ = B$ & I$
    GOTO 10
20  ETC.
```

After about 3K of data had been sent I kept getting the error message:- MEMORY OVERFLOW. What was happening was that the '&' was causing the HP85 to copy the 3K so far sent out of the 26000 bytes reserved and into unused RAM! This process resulted in the error.

The 'fix' to this problem was to use substrings. A pointer to the next available character position within the main string was included and was updated each time the incoming record was placed into the main string. The record was placed into the main string by defining it as a substring of the main data string starting at the particular character position defined by the pointer. For example:

```
    INTEGER K, L
    DIM I$[75], B$[26,000]
    B$[2], B$ = " "
    K = 1
    SET TIMEOUT 10 ; 10000
    ON TIMEOUT 10 GOTO 20
10  ENTER 10 ; I$
    I$ = I$ & CHR$(13)
    L = LEN (I$)
    B$[K, K+L-1] = I$
    K = K + L
    GOTO 10
20  ETC.
```

The concatenation of I$ and the record separator (the c/r) with the ampersand is not important since a maximum of 75 bytes of free memory is required for the operation. The important thing to note is the use of the substring. The HP85 BASIC, in performing this operation, works directly on the string and within the memory space allocated to it. There is none of the overhead required as for the '&' operation. This amended program had no trouble taking the data from the recorder.

Submitted by Ken Cronin,
Survey Division M.M.B.W.
B.H. (03) 615 4095
A.H. (03) 736 1037

TO ALL HP86/87 USERS

We want you to be aware that we have discovered a limited number of operating anomolies which, in certain applications, can adversely affect the ROM's performance. In keeping with HP's commitment to provide customers with products of the highest quality, we have updated the code to correct these anomolies.

Below is a listing of the functions which have been updated by either revising the ROM's code or making changes in its documentation. We recommend that you avoid using the REPLACE VAR function as it may cause loss of the program. All other functions, if used in accordance with the documentation will provide satisfactory results.

The Revision B of the Advanced Programming ROM is available for shipment. Should you find the revised ROM set necessary to complete your application, simply supply the information requested below, peel off the labels from the top of both ROM #1 and #2, and send them in to the indicated address. You will be supplied with an updated set of ROM's as soon as possible.

Operating Anomalies which are corrected in REV B:

1. DATE$ does not work in program mode.
2. MERGE uses the last active MSUS rather than the MSUS specified with the MERGE statement.
3. REPLACE VAR gives unpredictable results and, at times, hangs the system.
4. FLAG$ used in calculator mode causes loss of calculator mode variables and may hang the system.
5. Programs are listed from line 1 after pausing rather than the current executing line.
6. SCAN with no parameters prior to SCAN with parameters may hang the system.
7. The AP ROM causes problems at times when binary programs are present and BASIC programs are run multiple times.
8. If a SCAN for a variable is performed on a program which has a missing line, and the LIST key is pressed after the MISSING LINE error is displayed, the system will hang until RESET is pressed.

Please add to your documentation:

1. XREF and SCAN always output lines 80 characters long. The printer line length specified in PRINTER IS is ignored.
2. SCAN and REPLACE VAR don't catch DEF FN parameters.
3. After executing a SCRATCHSUB from program mode, PAUSE followed by CONT gives a 'CONTINUE BEFORE RUN' error.
4. Executing a FINDPROG or CALL on an untranslated HP-85 program may produce unexpected results.

Please Supply:

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Company Name .....

Address .....

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31-41 Joseph Street,
BLACKBURN, 3130.

PUZZLE SOLUTION

The program prints the word 'COMMITTEE'

PROBLEMS WITH MIKSAM ROM & STEVIE BINARY

The MIKSAM ROM which is available for the HP86/87 Desktop Computers has a problem with one of its statements when used with Winchester Disc Drives. The binary used with the FILE/80 data base management programme called STEVIE has the same problem. the statements concerned are:

MAKE-KEY-FILE . . . (using MIKSAM)
MAKE-KEY-FILE . . . (using STEVIE)

Both of these statements work correctly when used with floppy disc drives.

If an attempt is made to use either of the above statements to create a keyfile on HP9134B (9.6 Mbyte) Winchester disc drive which has a large number of data entries in its directory and about one-third of its disc space occupied then an error occurs which states that the directory is full. I understand that in some instances the statements will fail on an empty Winchester. The statements will. however. work if a suitable sized NULL file exists anywhere in the directory.

When using FILE/80 RECOVERY or REDEFINE function it has been necessary to change these programs so that the new key files can be recreated on the Winchester. This requires the creating of dummy files before the RECOVERY or REDEFINE program re-packs the disc after deleting the old key files. The other way is to cause the programs to operate with data on dual floppy disc drives only and then copy the contents of the floppy discs to the Winchester afterwards.

Hewlett-Packard have a binary fix for MIKSAM called STEVE and a new version of the STEVIE binary which will enable the FILE/80 programs to work with the Winchester.

A. J. STEVENS,
Telecom Australia Research Laboratories, (03) 541 6532

Focus 1000

ENHANCING THE USE OF PERIPHERALS ON A DISTRIBUTED NETWORK

INTRODUCTION

The Australian National Animal Health Laboratory utilizes a distributed star NETWORK of six HP A-900 Computer Systems. All systems make use of the RTE-A operating system. DS-1000/IV NETWORK Software. IMAGE-1000/II Data Base software and Fortran 77. Attached to these systems, referred to as NODES, are a variety of peripherals referred to as RESOURCES. They include Discs. Magnetic Tape Units. Printers. Plotters. Digitizers. Graphics Terminals. Character Terminals and various forms of laboratory instrumentation.

The objective of the effort described in this technical note was to produce a set of software tools that would simplify the task of the application programmer and typical system user in efficiently utilizing the various RESOURCES distributed throughout the NETWORK.

The direction taken in satisfying the objective. dictated a specification that included the provision of:-

i) A set of easy to use programmatic CALLS that would enable an Application Programmer to make easy and efficient use of any RESOURCE on the NETWORK.

ii) A RESOURCE DEFINITION Data Base whereby any RESOURCE on the NETWORK would be referenced by logical name. The Data Base would provide the ability for mapping RESOURCE NAMES to LOGICAL UNITS and NODES. The Data Base would also contain control information on RESOURCE access.

iii) CONTROLLER's to supervise and co-ordinate all usage of the system, including cleaning up when programs aborted or DS links failed.

iv) RESOURCE MONITORS that would enable an interface between the Application Program and RESOURCES.

v) Special UTILITIES for controlling and utilizing the system.

The essential features provided by the specified system are:-

i) Centralized control of RESOURCE access.

ii) Automatic redirection from an unavailable RESOURCE to an alternative RESOURCE.

iii) Enable exclusive access to a remote RESOURCE if necessary.

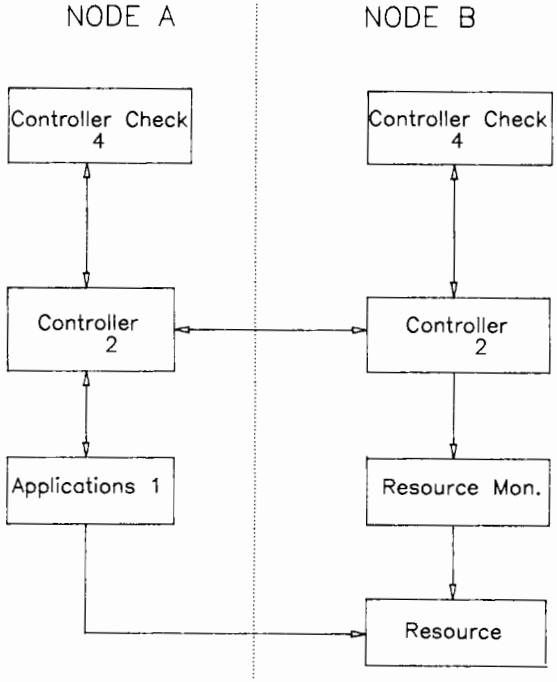
The system described in subsequent sections. details a solution to the above specification. from now on referred to as the NETWORK RESOURCE SUPERVISOR (NRS). The system was the outcome of a one month collaborative effort between Hewlett-Packard and C.S.I.R.O. Australian National Animal Health Laboratory. Ms G. Patterson participated on behalf of Hewlett-Packard. and Mr C. Doyle and Mr G. Grant participated on behalf of C.S.I.R.O.

The results of this work are presently being used by the Staff at CSIRO ANAHL.

The NRS system has been developed for use by Application Programs that are dependant on NETWORK RESOURCES. It is proposed that all such Application Programs developed at ANAHL in the future. will use the NRS system.

The complexity of this work is in a large part. due to the problems with LOCKING a REMOTE RESOURCE on the NETWORK. DS-1000/IV does not currently support remote device locking.

Network Resource Supervisor



1.1 Application Programming:-
Application Programs make use of a set of supplied subroutines (NRSFUNCTIONS) that interface to the NRS system.

1.2 Resource Definition:-
Every RESOURCE on the NETWORK is defined in the RESOURCE DEFINITION Data Base. A RESOURCE DEFINITION HANDLER, given a RESOURCE name, checks the Data Base for the existence and availability of a RESOURCE, and if so, fetches the associated NODE and LOGICAL UNIT, e.g. ADMIN PRINTER refers to NODE 100, LOGICAL UNIT 6.

The RESOURCE DEFINITION HANDLER makes redirection to an alternative RESOURCE possible, when and if a given RESOURCE becomes unavailable on the NETWORK.

1.3 Controller:-
Each NODE has an NRS CONTROLLER. The CONTROLLERS are the guardian angels over the NRS system, supervising communication between NODES.

1.4 NRS Table:-
Each CONTROLLER incorporates a reference table (NRS TABLE) that defines the relationship between a local calling Application Program, and a remote program, called the RESOURCE MONITOR.

1.5 Controller Check:-
Each CONTROLLER has an associated CONTROLLER CHECK program. The function of the CONTROLLER CHECK is to periodically instruct the CONTROLLER to perform an NRS system check.

This is performed to detect and clean up after any Application Programs that were making use of the system, at the time of an abort or DS Link failure. In operation the CONTROLLER CHECK calls the local CONTROLLER, requesting it to perform a system check. The CONTROLLER CHECK then places itself in the time list, where it is suspended for a time interval, currently 60 seconds, before looping back to repeat this process.

1.6 Resource Monitor:-
The function of the RESOURCE MONITOR is to interpret and execute requests from the calling Application Program, and where necessary return information to the Application Program. The RESOURCE MONITORS also provide a means for locking remote RESOURCES.

1.7 Utilities:-
The system offers a set of system utilities. Presently there are two, NRSUTL and MRD. NRSUTL enables the system to be started and stopped. MRD enables the maintenance of RESOURCE DEFINITIONS in the Data Base.

1.8. NRS Diagnostic:-
The NRS Diagnostic program, (NRSD), was written to assist in the initial system testing and debugging process. It displays the entries in the NRS TABLE on the LOCAL NODE, and if requested, reports the status of any REMOTE PROGRAM.

The NRS Diagnostic program will be used in the development of future NRS dependant Application Programs and also for general system management operations.

1.9 The Spooling Utility DSP, an Application that makes use of the NRS:-
This application was written using the NRS system, and enables users the ability to spool files from any NODE to any RESOURCE on the NETWORK.

It is extremely useful in the case of spooling to a printer.

The program uses the NRS system to identify the RESOURCE and hence the device or peripheral on the NETWORK. A special MONITOR, (DSMPM) is scheduled by NRS to interface the request to the device.

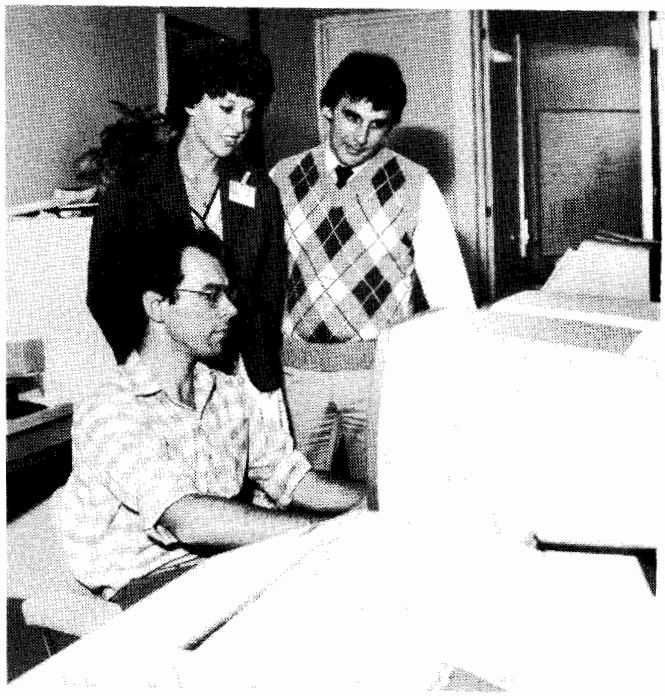
The DSP program is run interactively and accepts a file descriptor name and output RESOURCE name. The program fills in any defaulted parameters in the file descriptor. The file name is then passed to the MONITOR (DSPMN) and then to SMP to control the actual communication. (H.P.'s SMP system uses file NETWORK transparency to access files on a DS-1000/IV NETWORK).

This utility was very quickly and easily developed using the routines of the NRS system. It is the first of many applications and utilities planned for development using this system.

CONCLUSION
The NRS system provides the application programmer with a set of software tools, which extend the functions available to the DS/1000-IV subsystem user. It is planned that many future application programs developed at A.N.A.H.L. will utilize this system. The Spooling Utility DSP, was the first application written using the NRS system, and is currently being used extensively by the network users.

The information in this article aimed to provide an overview of the NRS system. For anyone interested in obtaining further details, Gary, Chris or Glenda will be happy to answer your questions.

GARY GRANT/C.S.I.R.O.
CHRIS DOYLE/C.S.I.R.O.
GLENDA PATTERSON/H.P.



Left to right: Chris Doyle, Glenda Patterson and Gary Grant working on the NRS System at C.S.I.R.O. A.N.A.H.L.

Wedding Bells

Any cause for complaint about this copy of Crosstalk may be put down to the momentous marriage of the new editor John Green to Kam Lin Seet. The happy event took place on 22nd December, 1984 in Perth.

He assures us that he will return to Melbourne and make an even better job of the next Crosstalk. Moreover he is adamant that Crosstalk will be published every two months.

Good luck John.

Congratulations also to Peter Hendy who was married early in October, 1984!

— C.S.

RTE INTERNALS

If anyone is interested in attending an RTE internals course, please contact Brett Hutchinson, Systems Engineer, Melbourne, (03) 895 2661.

8 Channel Multiplexer Interfacing Techniques

BILL JACOBS
TUSC Computer Systems Pty. Ltd.

Most HP1000 users connect their RS-232C foreign devices via HP's 8-channel multiplexer. This is not always (never?) a simple task.

Non-standard devices require non-standard interfacing techniques, and, believe me, the 8-channel mux allows plenty of these! The purpose of this article is to demonstrate some of them.

First, here is a summary of the 12792B (MEF series), 12040B (AL series) features:

(a) 8 independent I/O channels per card
(b) CCITT V.24, RS232C and RS423A
(c) full duplex, asynchronous only
(d) internally clocked at 50 to 19200 baud
(e) fully programmable
(f) dual 254-byte input and output buffers per channel
(g) type-ahead mode
(h) high bandwidth (8 channels at 9600 baud)
(i) flexible cabling
(j) modem support

Figure 1 shows the hardware and software components involved when a program talks to a device. There are two major points of interest here. First, the driver is separated into physical and logical parts. The physical driver talks to the mux interface, whilst the logical driver contains device-dependent code. The logical driver may be HP-supplied, user written or omitted altogether. Second, note the multiple hardware buffers, which can be controlled programatically. We'll return to these later.

Now let's get down to the nitty-gritty. You have your HP1000. You have your black box, together with some (probably inadequate) documentatior on communications. You might even have a cable. You connect it all up and send down a command. Nothing happens. It's not really surprising — there are three key issues that must be considered first:

(1) **Solicited Input:** who controls when data starts flowing from the device to the computer?

(2) **Handshaking:** how do I tell the device to stop sending data to me, and vice versa?

(3) **Termination:** how do I know when the device has stopped sending data to me?

I will deal with each of these in turn.

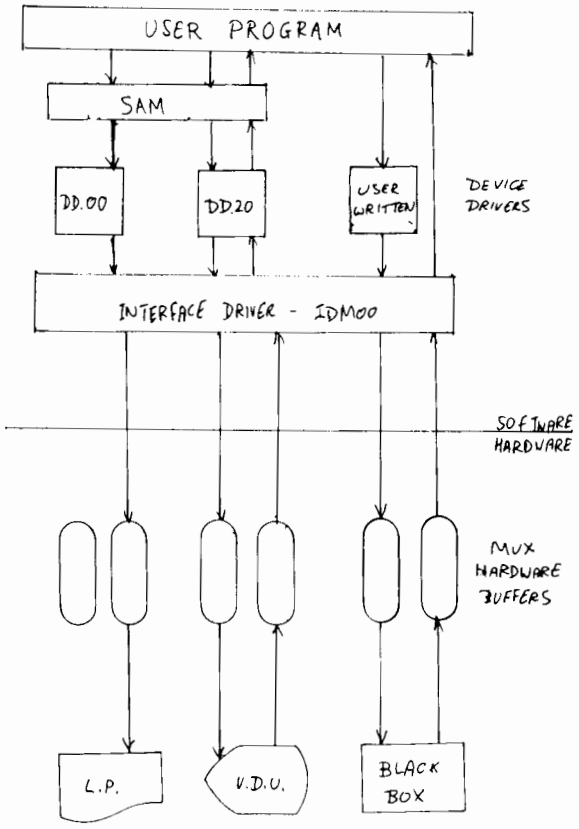


Figure 1

(1) **Solicited vs Unsolicited Input**
The key question here is: does the data only arrive upon our command, or can it arrive at any time?

If it arrives upon command, then simply issue a read request at the appropriate time.

If unsolicited, the type-ahead feature is used to catch the data.

We interrupt this article for a commercial break on type-ahead. When connecting a foreign device to the mux, chances are you will need the type-ahead feature. When type-ahead is enabled, any unsolicited input to the mux, rather than creating an interrupt, is collected on one of the hardware input buffers and can be read by the program later. Note also that, since there are two hardware input buffers, data can be collected in one buffer whilst your program is processing data from the other.

So if data is arriving unsolicited, collect it in type-ahead mode. Every so often, your program can switch input to the other buffer, and process the initial buffer. The only proviso is that the CPU must be able to process 254 bytes of data in the time that it takes for 254 bytes to be collected. This means coping with an average, rather than peak, arrival rate.

One word of warning with solicited input. It is wise to use type-ahead even in this case. If your program writes a command to the device, then places a read request, it is possible that the device will start sending before the read request is in place, resulting in lost data. Type-ahead prevents this.

(2) **Handshaking**
This is the means by which input and output is "paced" to prevent overflow conditions at either end.

Handshaking may be implemented in either software or hardware. Software handshaking involves control characters imbedded in the text. Hardware handshaking involves manipulation of the RS-232 control lines. Here are some of the more well-known techniques, and how they relate to the mux:

Enq-Ack
This is software handshaking used for output to all HP serial devices:

```
HP          Device                  Meaning

ENQ  ---->                          Are you ready?

     <----  ACK                     Yes

data ---->                          Here it comes
```

It is a half-duplex technique, in that data only travels in one direction at one time. The HP-supplied drivers optionally implement this.

DC1-DC2
This is used for input from HP terminals. For character mode reads:

```
DC1  ---->                          send me some data

     <----  data (CR)               here it is
```

For block mode input (user presses ENTER instead of RETURN):

```
DC1  ---->                          send me some data

     <----  DC2                     you will get a lot

DC1  ---->                          OK, I am ready now

     <----  data (RS)               here it is
```

The DC2 alerts the CPU to the fact that up to a page of data is coming, giving it a chance to prepare for it. Once it is ready, it signals this to the terminal with a second DC1.

XON-XOFF
This full-duplex protocol is a defacto standard, but it is implemented by the mux driver for OUTPUT ONLY.

```
data ---->                          CPU sends data

     <----  XOFF                    stop sending - my buffer is full

     <----  XON                     OK, start sending again

data ---->                          more data
```

Generally, the device sends an XOFF when its buffer is about 90% full, and an XON when the buffer has dropped to about 10% full. This gives the sender time to stop and start before the buffer becomes completely full or empty.

If you want to use XON-XOFF to pace input from your device, your program will have to output the XON and XOFF characters itself. This is not a particularly difficult task.

Hardware Handshaking
Some devices use the RS232 control lines to perform the handshake. The lines commonly used are RTS (request-to-send), CTS (clear-to-send) and DTR (data-terminal-ready):

```
RTS-CTS handshake:  (half duplex, analagous to ENQ-ACK)

                      ____________________
RTS (sender)    _____|                    |_______

                           ________________________
CTS (receiver)  __________|                        |_____

                           ____________________
TX (transmit)   __________|                    |_______
      line

DTR handshake:  (full duplex, analagous to XON-XOFF)

                ____      ____      ____      ____
TX (transmit)   |  |      |  |      |  |      |  |
      line      |  |______|  |______|  |______|  |
                ____________      ____________
DTR (receiver)              |____|            |____
```

The bad news is that the mux does not use these control lines. In order to implement hardware handshaking, therefore, you will need to use a protocol converter box.

(3) **Termination**
What condition signifies that input from a device has completed: i.e., what will cause the mux to transfer whatever data it has on the card to the user's program? The possibilities are:

(a) **Termination characters:** the arrival of one (or more) of:

```
CR              carriage return
EOT (control-D) end of file or tape
DC2 (control-R) block mode
RS  (control-^) record separator
```

The HP driver may be configured to trap for these termination characters.

(b) **User buffer full:** used when the input is always a fixed number of characters. A binary read for 'n' characters will automatically terminate on the nth character.

(c) **Time out:** wait long enough for the data to arrive
If all else will not work, then:

(d) **User-terminated read:** use a control call to force the mux to swap input buffers and transfer its buffer on the next read, irrespective of the data read.

User terminated reads provide the programmer with the ultimate control over black box input. It is used when variable length inputs are expected with no standard termination character: i.e., the program only knows that the input is finished by examining the data itself. Typically, it may be that the message length is coded into the first characters, or characters such as start-of-text and end-of-text are used to bracket the message.

Here is an example of a program, written in quasi (queasy?) Pascal, which will stream in variable-length data from a device. The message format is:

```
garbage  STX  data  ETX


BEGIN
     select type-ahead mode              ( EXEC 3, 33B call )
     select read length                  ( EXEC 3, 36B, 254 call )
     select end transfer on count        ( EXEC 3, 37B call )
     clear input buffer                  ( EXEC 3, 26B call )
     issue command to device             ( EXEC 2 call )

     clear USER_BUFFER
     set POINTER = 0
     set STX_DETECTED = FALSE
     set ETX_DETECTED = FALSE

     REPEAT
          terminate current mux buffer   ( EXEC 3, 52B call )
          read mux buffer contents       ( EXEC 1 call )
          IF NOT (timeout OR error)
               REPEAT
                    CASE next character OF
                         STX : STX_DETECTED = TRUE
                         ETX : ETX_DETECTED = TRUE
                    OTHERWISE
                         IF STX_DETECTED
                              bump POINTER
                              set USER_BUFFER[POINTER] = char
                         ELSE
                              discard garbage char
                         ENDIF
                    ENDCASE
               UNTIL all characters read are processed
          ENDIF
     UNTIL ETX_DETECTED OR we detect a timeout or error

     return POINTER = number of data characters read
     return USER_BUFFER = buffer read

END
```

Well, there were a few interesting EXEC calls used there. It is worth the time taking a very careful look at the multiplexer driver documentation to discover all the wonderful things that can be done.

Sesquepedalian Proverbial Parachrastic Circumlocution

For those of you who feel that you have a good command of the English language, see if you can identify the common sayings below. You may find a dictionary useful.

1. Scintillate, scintillate, asteroid minific.
2. Members of an avian species of identical plumage congregate.
3. Surveillance should precede saltation.
4. Pulchritude possesses solely cutaneous profundity.

To get you started, I will give you the first one — "Twinkle, twinkle, little star". If you found these a 'push over', watch for the next issue.

If anyone has their own collection of humorous trivia which may be suitable for general publication, could you please send me a copy.

Glenda Patterson,
HP Melbourne

COMING EVENTS

4th February: 'Introduction to RTE' Course, HP Sydney.
'RTE-A Prog. & Sys. Mgr.' Course, HP Melbourne.
'Series 200 Bas. Op. & Prog.' Course, HP Melbourne.
'Getting Started on HP150' Course, HP Melbourne.
'Wordstar on HP150' Course, HP Melbourne.
'Lotus 123 on HP150' Course, HP Melbourne.
'Condor on HP150' Course, HP Melbourne.
'Visicalc on HP150' Course, HP Melbourne.

11th February: 'Fortran 77 on HP1000' Course, HP Melbourne.
'Series 200 Basic Program' Course, HP Sydney.
'HP9000 UX Sys. Admin.' Course, HP Melbourne.

18th February: 'RTE-6VM Sess. Mon.' Course, HP Melbourne.
'Series 200 Basic Op. & Prog.' Course, HP Sydney.

21st February: HPDCUGV Meeting at CSIRO Geomechanics Div., Syndal, Vic. — More snippets plus Gordon Roberts talking about his 9000 desktop computer.

4th March: 'RTE-A Prog. & Sys. Mgr.' Course, HP Sydney.
'RTE-6VM Sys. Mgr.' Course, HP Melbourne.
'Getting Started on HP150' Course, HP Melbourne.
'Wordstar on HP150' Course, HP Melbourne.
'Lotus 123 on HP150' Course, HP Melbourne.
'Condor on HP150' Course, HP Melbourne.
'Visicalc on HP150' Course, HP Melbourne.

13th March: HP 1000 Technical Computer Users Group, Annual General Meeting, 4 pm. at HP Melbourne.

18th March: 'RTE-6VM Sess. Mon.' Course, HP Sydney.
'Introduction to HP1000' Course, HP Melbourne.
'MS DOS on HP150' Course, HP Melbourne.
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25th March: 'HP9000 HP UX Intro.' Course, HP Sydney.
'Getting Started on HP150' Course, HP Melbourne.
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