PhD 91/WES sec

REP.

AN INTEGRATED

EXPERT HELP DESK. AND NETWORK SUPPORT DATABASE

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Final Year Project for Nottingham Polytechnic

Bsc Computer Studies (Part-time)

in collaboration with Brush Electrical Machines Limited

SUMMARY

Brush Electrical Machines Limited (BEM) provides a wide range of electrical products from large generators (above 100MW output) and traction locomotives, to smaller electric motors and complex control gear that regulates the flow of electricity. There is a continuous drive to reduce lead time from receipt of a tender enquiry, to the completion of manufacture and despatch to the customer. As the majority of BEM's turnover consist of contract work which require varying amounts of design work, computer systems are invaluable in reducing this design time and therefore the overall product lead time. As with many progressive international companies there is an ever increasing reliance on computer systems to provide the necessary business tools required for use by many different (and inter-related) departments within the organisation.

With this in mind it is not surprising that the proliferation of computer facilities has increased over the years and is growing at an ever increasing rate. The associated computer systems support required to maintain an efficient and reliable service to the business needs and users of them has increased also. In order that the service provided by the Computer Services Department (CSD), is of a high quality then their own internal systems for Administration, Support, Planning, Scheduling and Performance monitoring etc. must be flexible, efficient, accurate and easy to use. Automation of any functions is very desirable to make best use of the limited human resources available. To achieve this, computerised systems are required which will automate procedures and provide computer staff with the necessary functionality required to meet their objectives.

Therefore, a systems analysis and design of BEM CSD has been performed in order that problem areas are resolved, ensure business needs are met and implement new systems to facilitate the departments operational requirements to meet this ever increasing burden placed upon it.

As a result of this analysis and design a number of sub-systems, (Help Desk, Expert System, and Network Support), has been implemented using a combination of Oracle's SQL*forms and Sun's SunNet Manager packages, and integrated via a central database system, (Oracle RDBMS), all running on a networked RISC based Sun SPARC workstation running under the UNIX operating system.

The Help Desk provides CSD the necessary facilities to deal with user calls for assistance in a quick & reliable manner. Fault calls are logged, (for future analysis of recurring problems; and to progress calls), and retrieval of any hardware or software related information, (such as PC configuration data), is fast & accurate.

The Expert System allows CSD staff to solve various faults interactively with the caller and thus clear the problem very quickly even if no Technical Support staff are available.

The Network Support system is responsible for the allocation of unique network node identification information, (internet addresses), technical details of communication equipment, and a graphical representation of all computer & communications equipment used. In addition to this, computer and network performance statistics can be produced for analysis.

This new system has been developed with company computing strategy & policies very much in mind and as a result an Open System application has been implemented.

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TERMS OF REFERENCE

This report was produced by the author in response to his final year project for Bsc Computer Studies (Part-time) at Nottingham Polytechnic.

The format of the report has been specified by the authors project supervisor.

REPORT PROCEDURE

An investigation and analysis of Brush Electrical Machines Limited, Computer Services department is performed in-order that problem areas are resolved, ensure business needs are met and implement new systems to facilitate the departments operational requirements to meet the ever increasing burden placed upon it.

Due to the integrative nature of this project the author has drawn on many of the level 1 and 2 units of his course, (particularly the Business Information Systems topics), and many of the level 3 units. Appendix G acknowledges these and other sources of information.

The project plan is described in detail in Appendix A.

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INTRODUCTION

1.0.0 INTRODUCTION

The area under investigation is Brush Electrical Machines Limited (BEM), Computer Services Department. This departments main function is to ensure that computer systems and developments are harmonised into, and support the business of Brush Electrical Machines (G.2.). As the company evolves so too do the users and business requirements and as a result an increased burden is placed on Computer Services to provide the necessary computer systems to facilitate these requirements. Therefore, Computer Services must be flexible enough to respond to these changes, that is all computer developments are business driven. To gain a thorough understanding and appreciation of the size and complexity of this task the following is a brief introduction to this company and the computer services department in particular.

Brush Electrical Machines Limited based at Falcon works, has long been the University Town of Loughborough's largest factory group. The Falcon Works was first founded in 1855 by a Henry Hughes of the firm "Henry Hughes & Company Locomotive Engineers". His factory made saddle-tank locomotives and horse-buses. In 1863 he moved to a site by the Midland Railway Station.

A Mr. Charles Francis Brush was born in Cleveland, Ohio in 1849, became an American inventor of arc lamps and street lighting and had developed his first dynamo by 1876. The forerunner of BEM, the Anglo-American Brush Electric-Light Corporation was founded in 1879 in Lambeth, London. In 1889 Charles Brush bought the Falcon Works of Loughborough. Soon Brush was producing equipment to supply whole towns with their first electricity. At the same time it was constructing 250 tram cars a year.

In 1901-05 the Brush Company developed the 'Brush Light Petrol Motor Carriage' which was available in either 2cyl. 10 hp or 4cyl. 16 hp models. In 1904 2 Parsons turbines were made for Loughborough's first power station. Also a mainline freight loco. the 6 wheel coupled Bissel-Bogie class C locomotive @ #2000 each. The new Great Central Railway ordered Brush rolling stock in 1906. By 1910 there were 2000 Brush employees.

In 1915 at the request of H.M. Government the company agreed to build aeroplanes for the war effort. Designs manufactured on site included the AVRO 504K and a reconnaissance aircraft the Maurice Farman S.7 Longhorn.

Leicester's new bus fleet in 1924 all had bodies built by Brush. In 1929 Charles Brush died. The last tram-cars were soon followed by the first trolley buses in 1932 then in 1933 came the horizontal diesel engine. In W.W.2 the Brush war effort turned to aircraft repair and the building of army vehicle bodies, gun mountings and the Dominie aircraft. Postwar developments included new diesel loco.'s made for both BR & for export. In 1949 bus body production totalled 60 per month but has since been discontinued.

In the 50's and 60's over 260 class 31 diesel/electric locomotives, and over 300 class 47 loco's. were built at Loughborough - most of these are still in use. In addition around 400 sets of electrical equipment were built for use in British Rail loco's. Five thousand traction motors were also built for the London underground. In October 1960 the Falcon Works employed about 4300 workers in 40 acres of workshops in a total site area of 59 acres. The site has grown 1000% since it was taken over in 1889. It was originally 7 acres but is now 70 acres employing about 2500 employees and is the largest subsidiary of the multi-national Hawker Siddeley Group. On May 24th 1988 BEM, in the face of stiff competition from a General Motors/GEC consortium was awarded the entire contract from BR to build 100 class 60 diesel/electric freight locomotives at £1.2M per loco.

Other recent contracts awarded to the Brush include: 11 Turbo-Generators for the middle East & China, 28 diesel generators for places such as India & Canada. 2 synchronous motors for the UK & Japan and many of other contracts including one of the largest to any one company for the channel tunnel locomotives. A £20M order for 20 class 92 electric locomotive for British Railways to be used primarily for freight on the French side of the tunnel. Delivery of this is due mid 1992. From this it can be seen that BEM is a fairly substantial set up with many business needs and as such will obviously process a great deal of information coming into & out of the company.

1.1.0 THE INITIAL APPROACH TO COMPUTING AT B.E.M.

In order to produce competitive tenders & quotes to win new contracts the required products need to be produced at the highest possible quality in the most efficient cost effective way and deliver on time worldwide. The extensive flow of information throughout the company needed to meet the above objectives can only be met by the use of BEM's computer systems. The two main demands on the computers are Commercial & Technical and because of the very nature of this business these two main systems have many points of contact and several major areas of overlap. Within any department a great deal of time is spent in handling data which originates from or is destined for other departments. As 'people' costs escalate it's essential that this waste of effort is cut out and that the computer is utilised to clear this log-jam of information, (see Figure 1.1 Office Activities).

Not only is time expensive but so is the material used for recording data and the various filing systems. If these various manual systems are replaced by one common easily accessed system then we will have a more beneficial result if only because each department will be given the same answer to the same question. The computer systems have been developed over many years and now embrace most activities carried out in the company. However, this computer development must not stop but on the contrary speed up in order to keep one step ahead of competitors as the company strives to increase efficiency and also to meet the changing needs of the business users. This is no easy task and some thought must be given to the support of these systems.

BEM's computing history started with mechanical adding machines in 1944 with Power-Samas, Holarith and ACT 555 tabulators for the financial departments. In circa 1953 BEM designed & built the Brush Automatic Synchronous Transistorised Arithmetic Digitiser (B.A.S.T.A.D.), which used a magnetic drum as the main storage area and had 4 main RAM registers made up of delay lines. This computer along with an analogue computer purchased shortly after were used for studying the stability & behaviour of control systems such as those used by the Jodral Bank telescope motor drives which was just being installed by BEM. An Elliot 803 was bought in 1961 for use in machine design and other technical and N.C applications.

A programming language written by the Brush was used to program on this 4K RAM machine. In 1963 an ICT 1301 with 32K drum was bought for financial and stock systems followed by an ICL 1902 for production departments. The Elliot 803 was scraped in 1972 and in 1973 the computer systems went from batch to on-line. In 1979 a Data General Eclipse C350 with 500K memory was bought for word-processing & general use. As the data processing requirements grew more D.G computers were bought to meet the demands placed on them.

The current hardware & software configurations currently in use at Brush Electrical Machines are detailed in Appendix C.

Inter-personal	**60**	33	12	15
Document Handling	20	**40**	**40**	20
Document Creation	18	23	**40**	**60**
Other	2	4	8	5
	.	.	.	.
	Managers	.	.	
		Professionals		
			Clerks	
				Secretaries

Figure 1.1

Office Activities

The **highlighted** percentages represent those areas which commercial software producers have concentrated on in order to sell more software under the heading of office automation.

Types of Office:

Managers, Professionals, Engineers = Decision makers

Clerks, Typists, Messengers = Transactions

The three major areas of computerisation are DECISION SUPPORT SYSTEMS (rare), TRANSACTION PROCESSING (universal), & AUTOMATED OFFICE (growing quickly).

The above diagram (source year 3 Dr.Ashworth Lecture notes) highlights those areas within a company which are typically labour intensive and therefore good candidates for computerisation.

1.2.0 SUMMARY OF PROBLEMS

As a result of the high volume of information and record keeping involved in Computer Resources; the large geographic area of BEM to be supported; and the large variety of software, hardware & operating systems the following is a brief summary of the problem areas:-

1) Lack of formal procedures for documenting the acquisition, installation and support of hardware & software.
2) Lack of automation in record keeping.
3) Highly skilled staff performing far too many mundane jobs.
4) High volume of phone calls.
5) Lack of standards in installation of hardware & software.
6) Lack of inventory records for hardware & software.
7) Lack of inventory information for equipment maintenance records.
8) Lack of networking records & diagrams indicating location and configuration of communication lines.
9) Poor response to user calls.
10) Anticipated increase in over all load.
11) Work duplicated per installation or planning stage between sections, if not aware that a similar/same system is/was being developed already.
12) No performance monitoring of hardware. Difficult to spot bottle-necks when considering to expand a system.
13) No performance monitoring of response to fault calls. Hence, weaknesses from users point of view are not highlighted.
14) No network administration information. Relatively new concept such as the allocation of unique network addresses.
15) Access to existing records slow and error prone.
16) Maintenance of existing records difficult.
17) Not easy to determine what existing applications are available within a department.
18) Planning new systems difficult if a clear view of existing one is not clear; need aids to help plan future network requirements.
19) Scheduling of fault calls & fault visits is not very well controlled.
20) Chasing outstanding fault calls and clearing old ones, e.g the follow up on a fault, is poor.
21) No central contact point, due to all the areas of overlap of responsibilities and expertise. Poor fielding of calls.
22) Some systems are dependant on just a single person not a group.

Any solution to these problems must be **easy** to maintain.

1.3.0 SUMMARY OF SOLUTION

A statement of the solution, for those wishing to skip the preceding sections, can be found in Chapter 3. However, a very brief summary of the solution has been extracted and is as follows:

The problem areas highlighted and other specified requirements can be dealt with by a computerised system consisting of a database; an expert system, a help desk and network support systems. All these sub-systems will communicate and integrate through the database management system (DBMS) which will be at the core of the system.

1.4.0 SOURCE/REASON FOR PROJECT REQUEST

1) In response to the recognition of these problems management require a full analysis of the problems with a view to providing a solution which meets the following criteria:-

   a) Augments the company/department computer systems strategy & policy
   b) A system which meets or contributes to the company's business needs

2) To improve the quality of service provided

3) To Save time, trouble, and money in the areas of . . .
   . . . Administration
   . . . Support
   . . . Planning
   . . . Scheduling
   . . . Performance monitoring

4) In response for a need to produce a final year project the author has chosen to accept the challenge of detailing a system which will meet the short term and the long term requirements of BEM Computer Resources.

1.5.0 SIZE & SCOPE OF PROJECT

The database at the heart of the system has to be developed so that it meets all the foreseeable requirements. If this were not the case then it would make it very inflexible for future developments, such as additional sub-systems.

The author will not necessarily attempt to encompass every aspect expected of a help desk but only those necessary to meet Computer Resource's requirements. The expert system potentially has almost limitless size due to the many various systems, hardware & software, that are used and their associated faults and problems that can occur. Therefore, the expert front-end is designed in such a way that future expansion is as easy as possible. Those areas which will gain the most benefit from an expert system are implemented first.

The network performance & planning systems again are developed to be as flexible as possible with limited graphics capabilities. The limitations posed on the systems to be developed are due mainly to the lack of time, but more serious limitations are brought about by the availability of software or documentation. This becomes increasingly apparent for such things as PC network cards, (devices which enable PC's to communicate via networks). One of the requirements of the network support sub-system is to provide statistical information on the network traffic. This involves implementing a software system which will gather information from each node on the network. Although UNIX workstations pose no unsurmountable problem DOS PC's, which constitute the majority of network nodes use '3COM' communication cards such as 'Etherlink II' for Ethernet protocol control. However, no available documentation exists in this country which would otherwise describe how the cards and associated software drivers interact at the 'packet level' with the PC. This therefore prevents the author amongst others from developing software which could interact with these devices and thus intercept each packet of data received by the PC and log its details for latter correlation, (in general, PC's do not generate much network traffic and therefore are not such an important consideration as first thought). The other alternative is to buy commercial packages to install on the PC's. Unfortunately this is not financially feasible for BEM to implement commercial packages on every PC which would be necessary to build up a complete picture.

Also, PC packages tend to do more than is required and in doing so are far more complex and thus memory hungry which a number of PC's can do without. (Networked PC's already have a lot of software running in the background simply to control the network activities, not to mention the applications running on them. Also PCDOS presents a problem with its 640K memory limit and single thread processing. A number of BEM PC's are already up to capacity in terms of memory.)

UNIX workstations and OS/2 PC's do not present the PCDOS memory limitations nor the single thread processing. It is viable now to explore the possibility of installing network monitoring software on these computers. Commercially available products will be evaluated within this report as an alternative to in-house written software.

The scope in terms of people, time and money is that all information gathering processes will be conducted by the author alone. The deadline for the finished system and documentation is 6 May 1991. All of the authors holiday entitlement and more was used up during the course of this project because there was little or no time at his place of work to concentrate on this project. This project was conducted under the assumption that no hardware or software would be purchased by BEM for the purposes of this project. However, it was assumed that a SUN UNIX workstation would be available as a result of another, completely separate, project which the author was also responsible for. Therefore, he made the most of this opportunity by specifying hardware & software required to support the systems being developed in this project.

CHAPTER 2

LIMITATIONS OF EXISTING SYSTEM

2.0.0 LIMITATIONS OF EXISTING SYSTEM

2.1.0 COMPUTER SERVICES DEPARTMENT

The history of the formation and evolution of BEM Computer Services department can be found in Appendix D. This appendix helps to describe some of the potential problem areas and appreciate the importance of having a well organised and efficient system to support the computer systems.

2.1.1 Growth in Computing Problems

The full potential of the companies computing power is not been realised due to a number of reasons, such as a lack of training and support for the users of these computer systems and also a lack of planning and investigation into new developments.

All the resources of a company have to managed and activities coordinated to enable the efficient use of these resources and thus provide a smooth, efficient operational environment in which to work. Hence, all business needs are met quickly, accurately, profitably and at the same time create a good image to the customer.

Although these problem areas are been addressed through the use of user training schemes, the ever increasing rate of growth in computing facilities that are been installed, along with the support of existing systems, compound the problem of the effective management of all the computer resources.

2.2.0 PROJECT REQUEST

Technical support helps provide the services required for the effective management and support of computer resources as mentioned above.

The Computer Services department consists of two main areas; the applications section and the resources section. The reporting structure can be seen in Figure 2.0 below. The applications section is primarily responsible for the development and maintenance of in-house software systems. These systems are written in a 3GL such as Cobol or Fortran, and 4GL Oracle.

The resources section consists of 4 main areas; office automation, operations, technical support, and data preparation.

Described very briefly. . . the Office automation area is concerned with the implementation, support and training of desktop computer based solutions, typically personal computer (PC) running commercial software for wordprocessing, spreadsheet and database applications.

Operations is concerned with the day to day running of the large centralised company computer systems which involves loading magnetic tapes & disks; servicing the peripherals such as line printers ensuring that they do not run out of paper etc.; distribution of printouts; computer consumable stock control; and monitoring & controlling various software systems such as batch programs and bank automated clearing systems (BACS) data transmissions.

Data Preparation is responsible for the keying in of paper based data.

Technical Support, the area in which the author works as a Technical Analyst, objective is to 'support a secure, optimised computer resource for BEM'. The activities involved are many and varied and have a high profile for providing the necessary management service & support for a large number of activities and resources. Technical Support is responsible for offering and implementing technical advice to any one requiring it but in particular to management decisions when providing new services or applications such as the installing (or modification) of new visual display units (VDU) to access new or existing computer systems; PC's to run packages as already mentioned in office automation above; workstations to run larger applications such as computer aided design/manufacture (CAD/CAM); and networking solutions.

Technical support act as consultants to the user base in assisting them with any problems such as the handling of any hardware or software faults. This may involve a large degree of liaison with any/all of the other sections within computer services during the course of fault analysis, (as is the case for any new hardware or software developments). Technical support staff will attend to the fault the user contacted them about and if necessary report and log these calls with a third party maintenance company.

COMPUTER SERVICES ORGANISATIONAL STRUCTURE

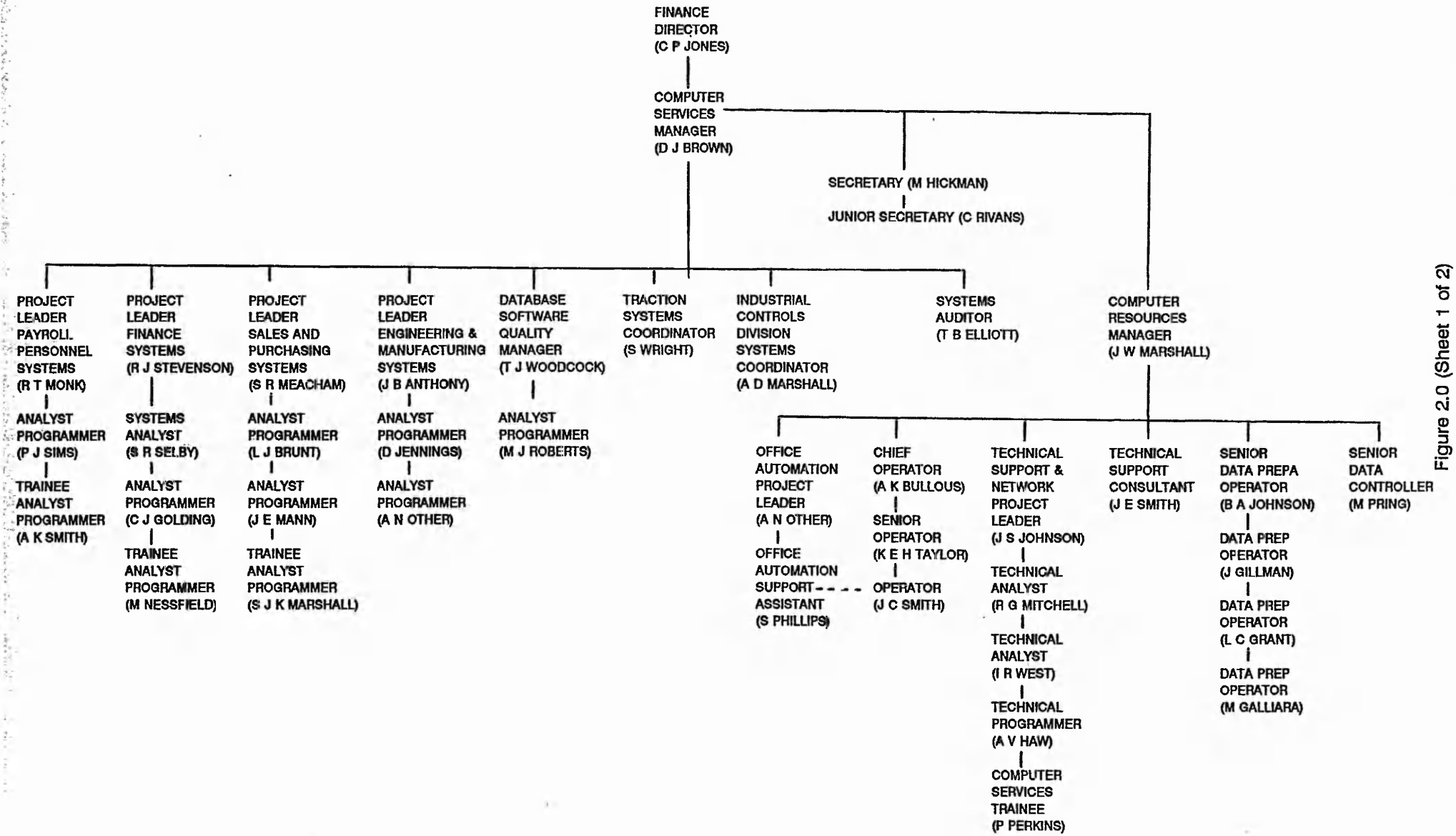


Figure 2.0 (Sheet 1 of 2)

BRI[illegible]H ELECTRICAL MACHINES LIMITED

Industrial Division - Organisation of Meetings

Light shade indicates revisions to the structure prior to Executive Meeting 14 August 1990

Dark shade indicates revisions proposed at the Executive Meeting on 14 August 1990

Created 23 August 1990

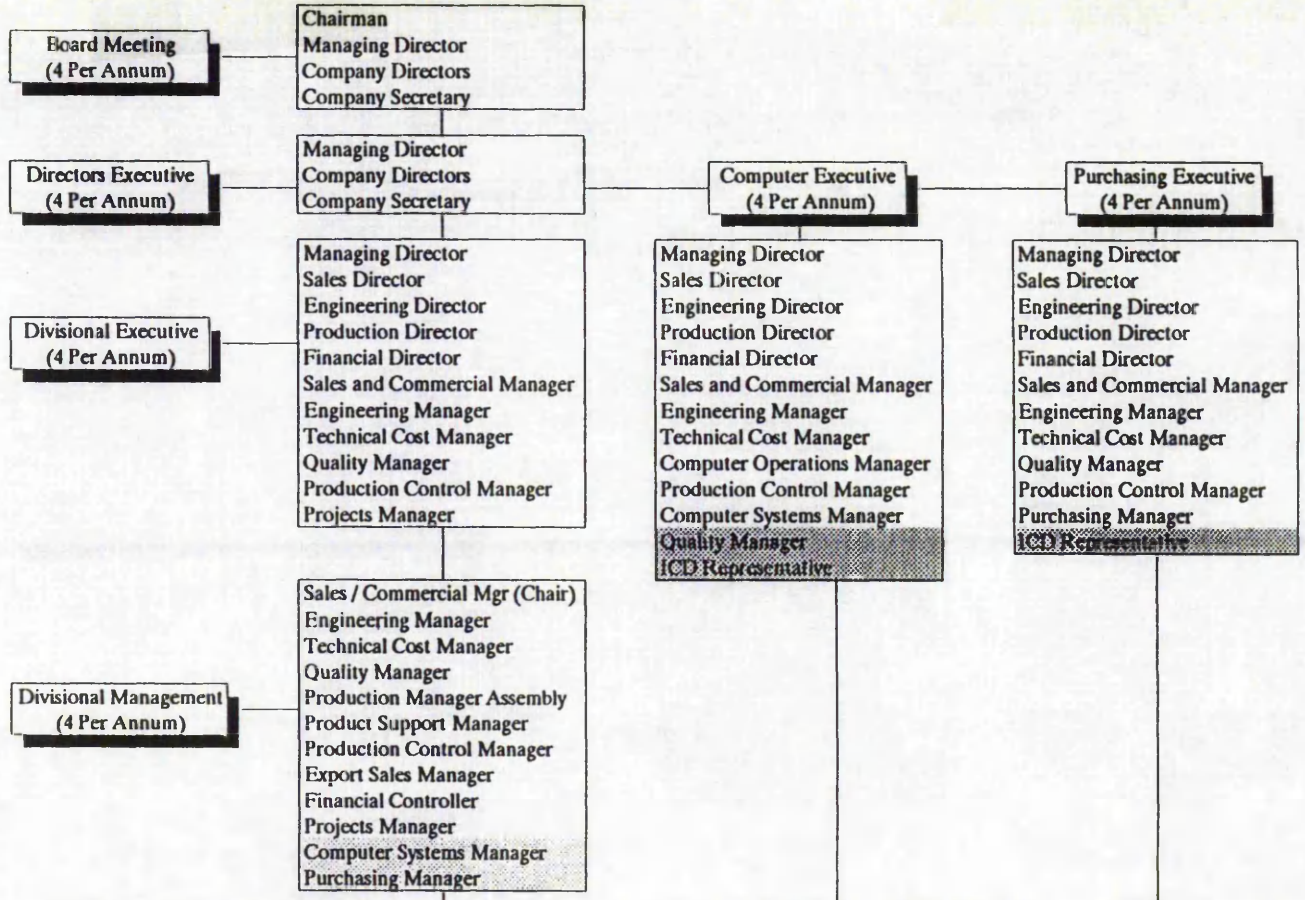


Figure 2.0 (Sheet 2 of 2)

Other Technical support duties include training users in the use of hardware (or software) systems; the scheduling of regular maintenance of these systems; anticipation of future requirements; system programming and keeping documentation and other records up to date.

2.3.0 TECHNICAL SUPPORT CHALLENGES

Networking is a relatively old technology but is relatively new in its implementation within businesses or other smaller companies. As the benefits of networking become more apparent their use increases, as is the case within BEM.

Networking can be very costly especially if the proliferation of it is not managed and future requirements perceived at an early enough stage and if a number of different not necessarily compatible, separate networks are implemented. As the technology of PC applications increase so do the number of network functions, (see appendix B for details on the evolution of network solutions in the office).

Workstations which offer even more powerful network functions offer a new challenge in terms of planning for the most effective configuration and implementation of these machines. Since the cost of these workstations and associated networking is higher than that of PC's, (although this cost is decreasing dramatically to the point that the bottom end of the workstation range are as cheap as the top of the range PC's which have less power than these workstations), and as such it makes economic sense to get the most out of a workstation. However, this is not as simple as it sounds since there are numerous ways to configure these machines on a network and every application has its own requirements. Another problem is that this implementation is still very new to a great number of suppliers and consultants alike.

Possibly due to their inexperience suppliers and some technical people have a tendency to over specify a system which would not otherwise be necessary especially if the requirements have been investigated more carefully.

2.4.0 STATEMENT OF PROBLEM

From the above introduction it can be seen that Technical Support have a high profile in the management support of Computer Resources and the diverse numerous range of computer hardware & software and together with the other sections in Computer Services form a team which is at the hub of the companies business computing facilities.

As the level and quality of service & support provided to these user departments is increased & improved, the level & quality of their productivity should increase also. Most business systems involve a high volume of transactions which require numerous calculations, sorting, storage & retrieval, classification and summarisation. These are the types of job a computer system is very good at and so additionally benefit the user.

However, it has been recognised that Computer Resources is struggling with its responsibilities in support & service as the company expands and with it the proliferation of computer systems. 80 PC's were purchased in 1990 in addition to the existing 150 PC's on site and a further 80 part delivered during 1991.

The following is a brief list of problems generated as the number of installations increases:-

1) The potential rate of upgrades of existing equipment increases (to keep them in line with new systems for reasons of standardisation, compatibility, problem solving)
2) Regular preventative maintenance burdens are increased
3) Unexpected fault maintenance burdens increase
4) User training increases
5) User support burdens increase

As more time is being spent on servicing the telephone enquiries for assistance less time is available for working on more worthwhile projects (such as this one) which themselves should help alleviate the burdens on computer resources, (a catch 22 situation).

As a consequence the response to user fault calls, enquiries and time for planning decreases. This has knock on effects such as creating a poor image of the computer department. As the waiting times for new improved systems increases user departments get increasingly inpatient and in the end decide that they can wait no longer and design & implement their own computer based solutions. This situation is described in detail in Appendix J as is termed computer anarchy. These do it yourself systems tend not to be compatible with future developments and do not follow any company policy, (a costly and unacceptable practice).

Systems and procedures developed years ago for keeping records, documenting installation procedures, and standards recommendation are out of date to meet the current demands in terms of automation and sophistication. APPENDIX W is a comprehensive list of current forms and procedures used.

As the volume of systems increases so does the burden placed on Computer Resources to document these installations for purposes of maintenance contracts, budgeting for next years expenditure, and purposes of licensing software. As a result of this the systems within computer resources are falling into disrepute. Simply as a consequence of poor documentation enquiries of the type connected with placing fault calls, budgeting for new equipment, configuration of PC's etc., designing/planning for upgrades/new developments are difficult to answer.

Problems are exaggerated when dealing with hardware and/or software requests or installations because the following areas of consideration increase in size (in terms of . . . volume, frequency, number, complexity etc):

. . . sources or suppliers of hardware & software

. . . applications

. . . departments or sections

. . . rate of requests

. . . rate of installations

. . . interaction with other systems

. . . network and integrity of overall system

These problems will effect the overall effectiveness of meeting the business needs in terms of coordination and efficiency.

If there are no configuration records of previous installations, or they can not be retrieved easily then it is impossible to setup a workstation say, with an application identical to another, in the same way. This then makes administration far more time consuming when either a fault occurs or an upgrade is required, a member of Technical support has to go and attend to it and will take him longer finding his way around the file structure if all the computers are setup differently.

Again, more time is spent by experienced staff on meeting the prime directive of servicing telephone calls and providing help so that less time is available for more rewarding projects such as developing systems to administer all the documentation of installations, fault logging, and configuration records more effectively.

2.4.1 Current Data Recording Methods

No computerised system exists for keeping a record of hardware or software products that are purchased, installed, under maintenance or any other associated information such as configuration details. Paper based systems exist in the form of individual members of staff keeping their own forms containing some information. The following is a brief description of some of the records that are kept in this state:

Hardware inventory contain the following . . .

- . . . serial numbers
- . . . make
- . . . model
- . . . location
- . . . purchase information

Software records contain the following:

. . . product names

. . . version numbers

. . . licence numbers

. . . purchase information

. . . associated PC

A survey was performed to determine the quantity of registered software on the company site. Two important aspects were required:

. . . how much software was legal or not

. . . determine potential danger of computer virus infection from level of software copying

This information was used to purchase replacement software for those machines which had illegal software and could justify its use. Those machines which could not justify the use of an illegal software package would have it erased.

This paper based system has the following limitations:

. . . slow access of records

. . . error prone checking off of legal machines

. . . slow update of information

. . . poor availability of access

. . . large amounts of paperwork.

Configuration details contain the following:

. . . screen dumps of parameter or configuration information generated by device concerned

. . . rough notes scribbled down

Maintenance details contain the following:

. . . list of types or makes of equipment

. . . associated maintenance firms & telephone numbers

. . . site reference numbers

. . . some serial numbers

Limitations

This list of information is inaccurate, in that as new equipment is purchased or installed the maintenance details are not updated. Also, no record of the expiry dates of any item are kept. Invoices have to be searched through to confirm expiry dates, or even if it is on maintenance.

Communication details contain the following:

. . . 'patch panel' listing indicates the make and model of all peripherals attached with

. . . associated computer system name and communication line number eg. console 10 HOSTH has a TATUNG VDU attached

. . . some communication configuration details are recorded, eg. BAUD rate 20ma etc.

Limitations

When items of equipment are installed / replaced / upgraded no corresponding change is made to the records kept. When configuration details are changed as a result of the above, again no updates are made. Level of interconnection of devices has increased significantly over the last 2 years. This is mainly due to the rate of expansion and corresponding installation of systems within the company. The Data General (DG) computer systems account for the majority of peripheral serial connections to a computer. The DG computer system (which is used for many various applications, purchasing, stock control, financial etc. see APPENDIX C.), has only limited capacity in terms of the number of serial ports available for peripheral connection. Thus, as the company expands the number of people required to operate the purchasing system say increases thus the number of VDU's required to provide this additional facility increases to a point where the DG computer which is used for the purchasing system runs out of serial ports.

At this point the additional VDU's are connected to the DG systems in various ways as follows:

. . . Data switch to allow 2 VDU's to share 1 serial port at a time

. . . Data switch to allow 1 VDU to access 2 serial ports at a time

. . . Intelligent Port contenders used to allow 40+ VDU's to share 12 ports.

. . . connection to another DG computer which uses its network bus to communicate with the required DG system.

This situation will only be reversed when the DG applications are either decentralised (long-term) or additional DG computers are purchased (short term). Until then the level of complexity of connections is very high and not easy to catalog.

Network details:

. . . none are kept

Limitations

Any future developments are difficult to undertake without a thorough knowledge of the existing system.

Summary

This information would be updated when installations were carried out. But due to a lack of resources (people & time) this information becomes out of date. Also, the limitations are a result of existing systems being. . .

. . . difficult to use

. . . difficult to maintain

As a result of inaccurate information say in the case of communication details the following problems arise:

. . . during fault finding tasks unable to check status of a port line if it is not known

. . . during fault finding may be mislead and thus takes a long time to cure problem

. . . during modifications the incorrect computer port line may be disconnected thus causing problems for that user, even causing a loss of data

. . . unprofessional image is created

. . . wrong maintenance firm may be called in thus incurring an additional charge.

2.5.0 AUTOMATED OFFICE PROBLEMS

As first introduced in the above some of the potential problems of an automated office (AO) environment are that:-

1) AO is a total solution and is expensive,
2) There are relatively few integrated products available,
3) Disagreement amongst vendors on the functions that AO should perform,
4) Incompatibility between different systems,
5) Two philosophies on methods of communications. The first involves the telephone exchange as the communications centre on the assumption its digital. The second involves distributed systems via a broadband site wide network.
6) Operational problems.

(Potential problems 1-5: First discussed in 3rd year Business Information Systems)

. . . all of which has to be managed by the computer services department.

2.6.0 MANUAL PROCEDURES

As first introduced in the summary of problems in Chapter #1 experienced Computer Resources staff perform many time consuming and mundane tasks. A critical survey of many of these tasks was undertaken in order to deduce the extent of the burden placed on Computer Resources staff and also to highlight any problem areas within these tasks and any limitations made more apparent. The results of this survey are in APPENDIX W.

(N.B. Authors note: In performing this survey of tasks and activities carried out within the Computer department, documentation was inherently produced describing these tasks. This goes part way to solving some of the problem areas described earlier, that is, a lack of documentation to follow for various formal procedures. Thus, the manner in which the tasks in Appendix W were documented, can be used as formal descriptions of procedures used.)

2.7.0 STATEMENT OF COMPANY STRATEGY & POLICY

An introduction to Information Technology is given in Appendix J.

The computing strategy and five year plan as defined in 1987 is given in Appendix L.

Since the appointment of a new computer systems manager, late 1990, a review of the computer services strategy was undertaken. This is summarized below:-

2.7.1 Objectives

- To plan and manage ALL aspects of computer developments, including computer aided engineering (CAE), within identified resource constraints.
- To review and manage ALL computer and related budgets
- To manage and coordinate project action groups

2.7.2 Requirements

That all computer developments are business driven.

The current systems support for BEM has evolved over the last 10 years, focusing primarily on the perceived system needs of individual departments. The process has resulted in:-

- 'Islands' of automation
- Complex information management
- Redundant duplication of information and system functions
- Inflexible systems, unresponsive to the changing business needs
- High maintenance load on Computer Services, (70% of development resource is spent on maintaining existing systems).
- Protracted new systems development timescales
- Poor systems documentation.
- An inability to provide accurate and timely management information.

It should be stated however, that the systems serviced the business needs at the time. In recent times user expectations have increased significantly, together with the demand for new systems, greater flexibility, more integration and the ability of systems to change with business.

Other specific requirements have also been identified:-

- Ad-hoc reporting.
- Better information retrieval
- Provision of decision support facilities
- Ability to integrate PC's and workstations
- Provision of "end user" computing
- Movement of data across different hardware environments

Systems Developments In the 1980's are covered in Appendix K. Against the above background, the information systems strategy to support the perceived business needs in the 1990's is described below.

2.8.0 INFORMATION STRATEGY

Information is currently stored and manipulated by the central resource. The amount of information required and used solely by the originating department compared with the overall business requirement is about 80% whereas 20% is company information. By storing data centrally, departmental versus company requirements become confused.

Consequently the recommended approach for future development at BEM will be to transfer the limited amount of company information to the central resource, the rest remaining within the department. This concept is called **distributed computing**, which reflects the way people tend to work where some of their time is spent working as individuals (Departmental computing) and the rest as members of a team (company computing). Both of these modes can be accommodated by BEM.

With distributed data, applications can access information in remote departmental files and the company database as if it were in local files.

Figure 2.1 shows the departmental distributed concept, the shaded areas illustrate the company element of the information.

2.9.0 APPLICATIONS SOFTWARE STRATEGY

The information strategy logically drives the software strategy to a combination of localised departmental software which will complement the company wide software. The Oracle 4th Generation Environment and Relational Database Management System (RDBMS) have already been selected for the company wide software platform. However, many programs and systems are supporting the business which were written in COBOL, a 3rd Generation Language (3GL), which prior to Oracle was BEM's main programming language. It is envisaged that some developments will continue using COBOL where the business benefits justify it.

Much more local choice and flexibility will be possible for the departmental requirements, consisting of a mix and match of "in-house" written software, and "off the shelf" packages. See Figure 2.1. The sponsoring department can now have a major input into the decision making process for software selection, with less constraints from Computer Services, providing the software conforms to company guidelines. A number of standards have already been defined in this area, eg. WORDPERFECT for wordprocessing, LOTUS 1-2-3 for spreadsheet work, and dBASE IV for local database applications.

The common denominator for interfacing these various systems will be the Oracle Environment for coordinating and controlling the company database, where it makes sense to hold data at a central point to allow users to share it. Data can be downloaded to workstations to be manipulated for individual users.

INFORMATION AND SOFTWARE DIAGRAM

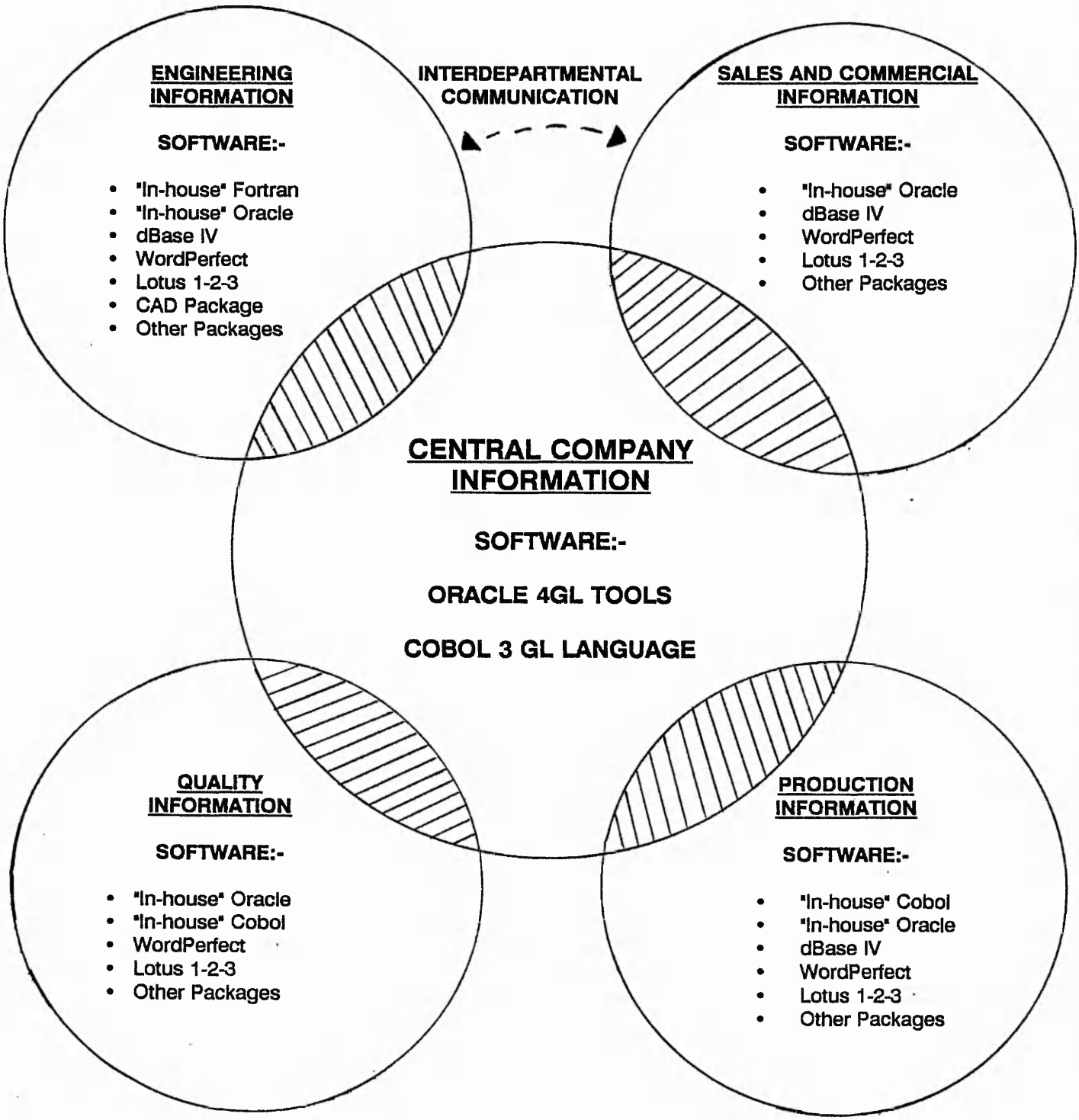


Figure 2.1

2.10.0 HARDWARE STRATEGY

Figure 2.2 shows the hardware configuration which will be required to support the information and software strategies, and the concepts of distributed computing. The computers and terminals on the network may be different machines with different architectures and operating systems from different vendors. There will be a combination of PC's, workstations and non-intelligent VDU's, but with a greater emphasis on workstations and computing power on everyone's desk. The workstation will be the person's "window" to the company and perhaps even to the world and will give access across hardware platforms from any vendors.

This method of distributed computing power has the benefit of ensuring that the performance and response will not be degraded by heavy use which is the current problem using the central computing resource. The local processor will take this load and only affect the person using the workstation.

If a workstation is being used for personal work this will require no access to other computers. If, however, departmental information is required then the desktop workstation (client) will activate the departmental computer (server) to provide the information back to the workstation. Similarly, if the departmental computer requires company information the central computer resource will be accessed. The concept of workstations/PC's accessing departmental computers which in turn access central computers is called the client/server architecture.

Distributed computing is the direction all computer vendors are moving towards, but the vital link in controlling it and ensuring information availability to the user is the **Communications Network**. Without this communications network distributed computing is impossible.

A well implemented distributed computing environment can decentralise information processing. Instead of building on larger and bigger central mainframes, it is found that networked PC's, workstations and minis can do the job. Computing power is increased by adding more machines to the network rather than replacing older machines with larger and faster ones. This gives the benefit of phasing the costs in incremental steps and reduces the financial risk of decision making.

DISTRIBUTED COMPUTING CONCEPT

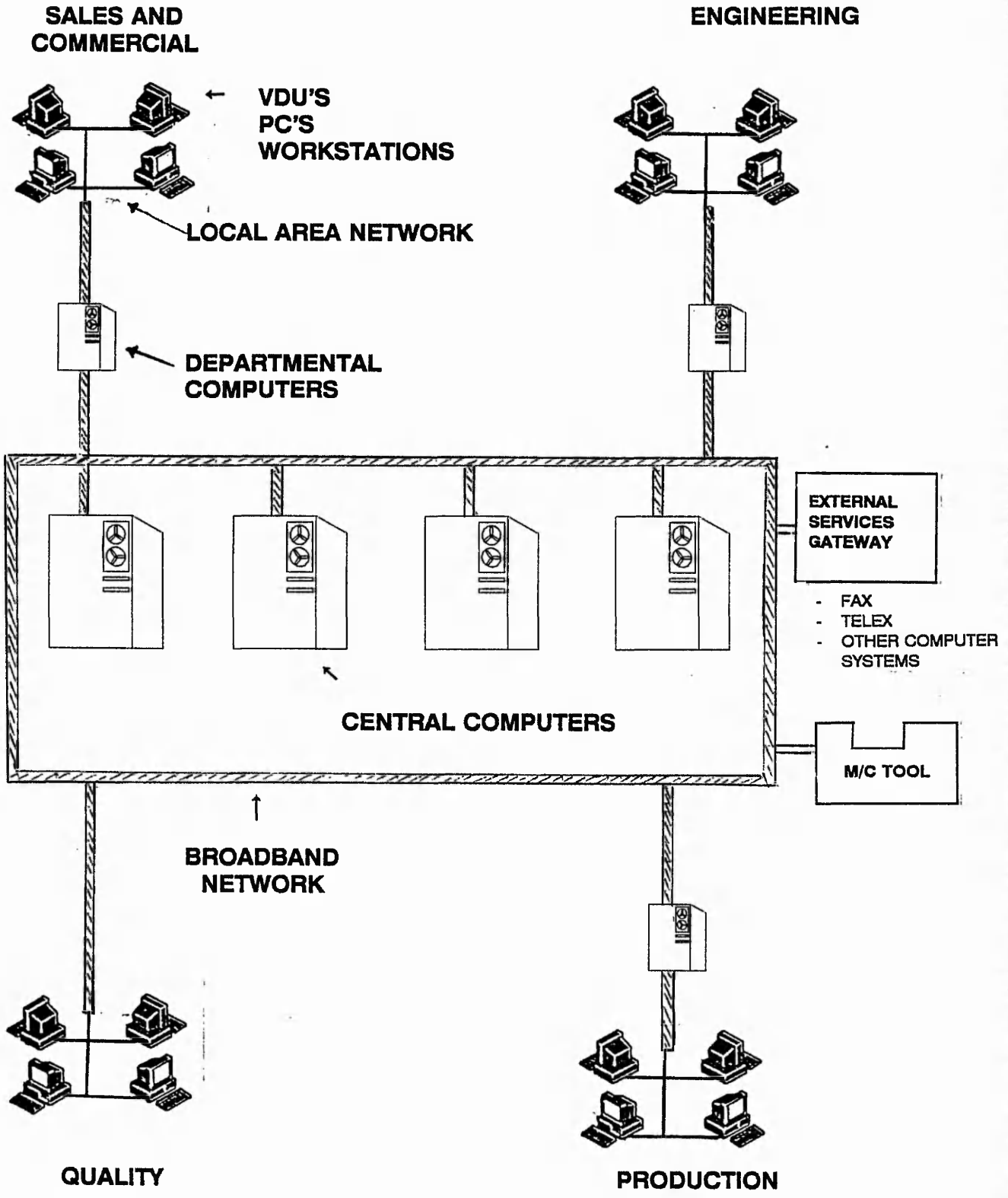


Figure 2.2

2.11.0 COMMUNICATIONS NETWORK

A communications network is critical for the concept of distributed computing as shown in Figure 2.2. Without it connecting the differing equipment together is impossible.

For departmental communications an Ethernet Local Area Network (LAN) will be used. This is a thin coaxial television aerial type cable along which digital signals can be sent. Communications software on the equipment is required to transfer the signals around a department and share system resources.

For the company wide communications and connecting the departmental systems together a **BroadBand** network will be used. This is similar to LAN except many more signals can be sent down the line at a time and is a much thicker cable. It is referred to as broadband because a wide bandwidth of signals can be sent down the line at the same time. This enables many services to be supported by a single cable acting as a multiwire supply. New services can be supplied without the added expense of additional cabling.

A communications backbone throughout BEM is a prerequisite of the overall information software and hardware installations and should be the objective of a separate project to ensure its installation.

A recent meeting by the computer steering committee have backed this idea and have suggested that the broadband cable be installed underground where possible. Although this will increase the costs by 10 fold the bad fall of snow last December and the havoc it caused has highlighted major problem areas which must be avoided.

2.12.0 OPEN COMPUTING

Computer manufacturers have been notorious for making it difficult to communicate with other vendors computers. This can be understood from a business point of view in that it ensures that the company is "locked in" to buying their equipment in the future. This is not acceptable at BEM if the strategies described above are to be pursued.

It is Computer Services policy that all hardware, software, and network equipment must conform to Open Systems Interconnection (OSI) standards where possible. This standard is still emerging and conforms to an International Standard Organisation (ISO) reference model, formulated with the aim of allowing computers to communicate freely with others supporting the same agreed standards, independent of specific manufactures equipment.

Conforming to OSI standards will assist in protecting the major investment required and making it as future proof as is practical today.

CHAPTER 3

DESIGN OF NEW SYSTEM

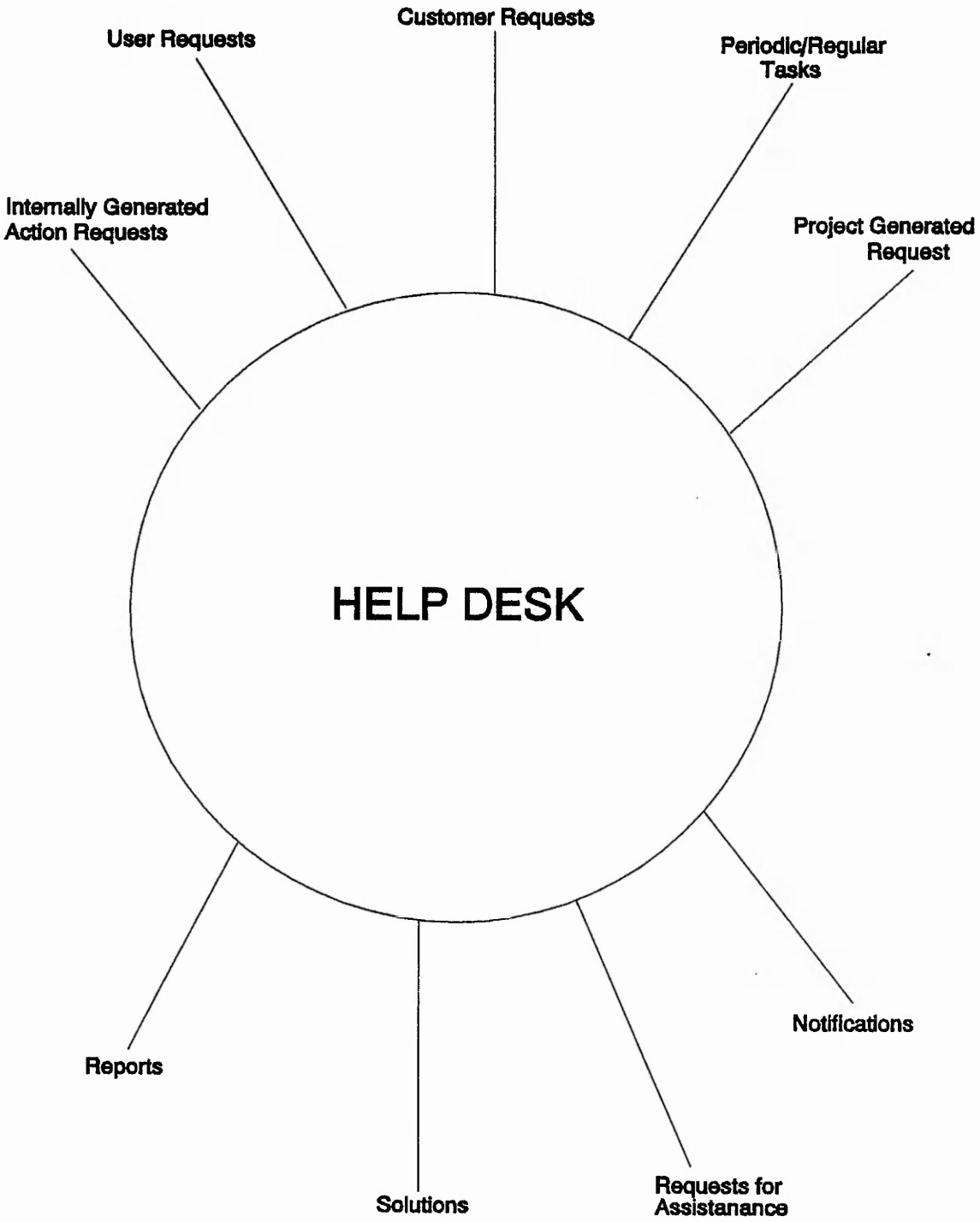
3.0.0 DESIGN OF NEW SYSTEM

3.1.0 CLARIFICATION OF PROBLEM AREAS

There are many forms of contact, communication and request generated within the Computer Resources Department. They are best illustrated by Figure 3.1 below.

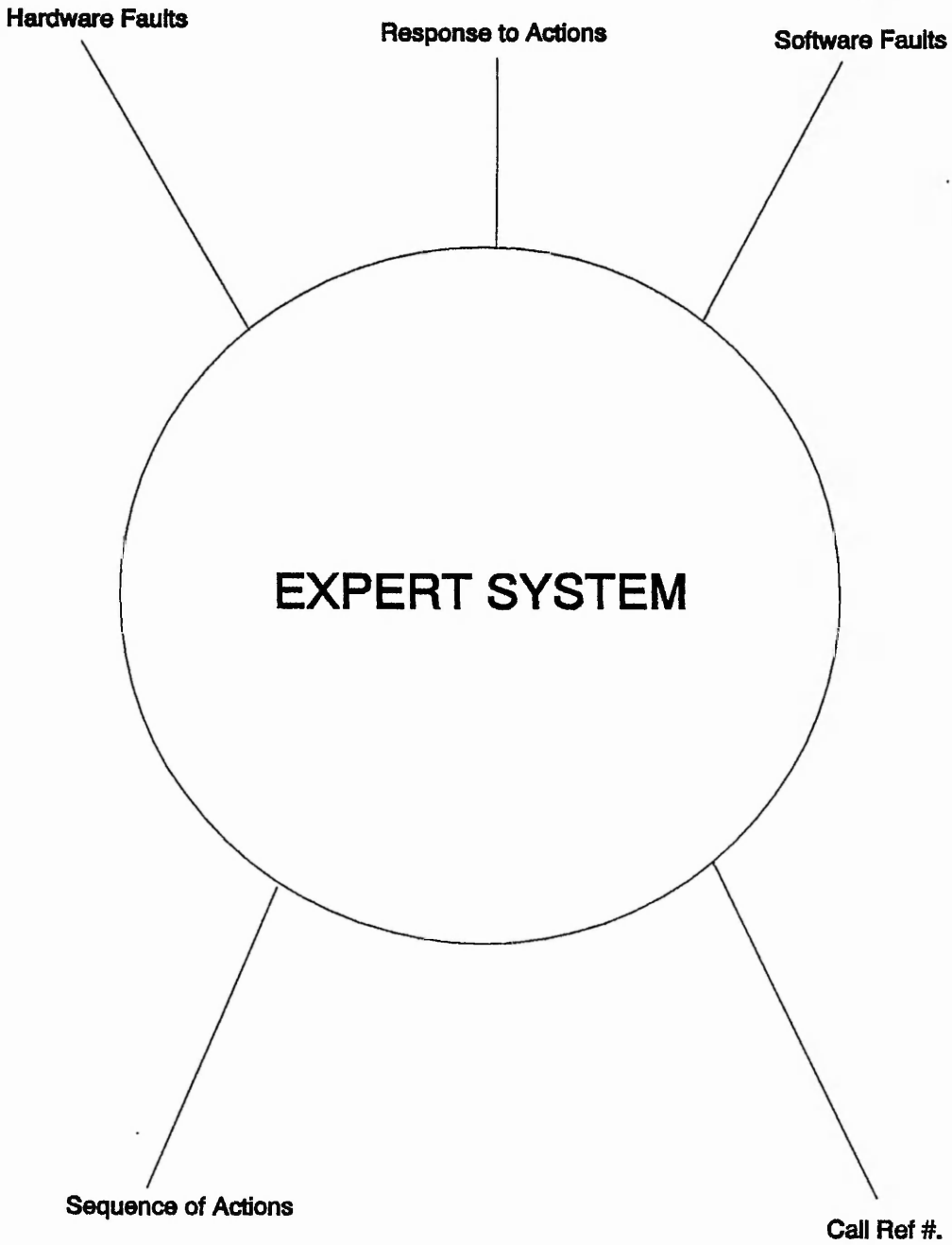
Users are the main customers of the Computer Services Department, therefore to be clear of who these users are and their view points and needs, a detailed study of their view is given in Appendix H.

To further understand the requirements of a Help Desk system, and thus database requirements, most of the major activities and tasks performed within Computer Resources are examined in detail. It should be pointed out that although not all of the following activities will be implemented within a Help Desk environment it is helpful to know the areas of potential expansion. The details of these routines are given in Appendix W.



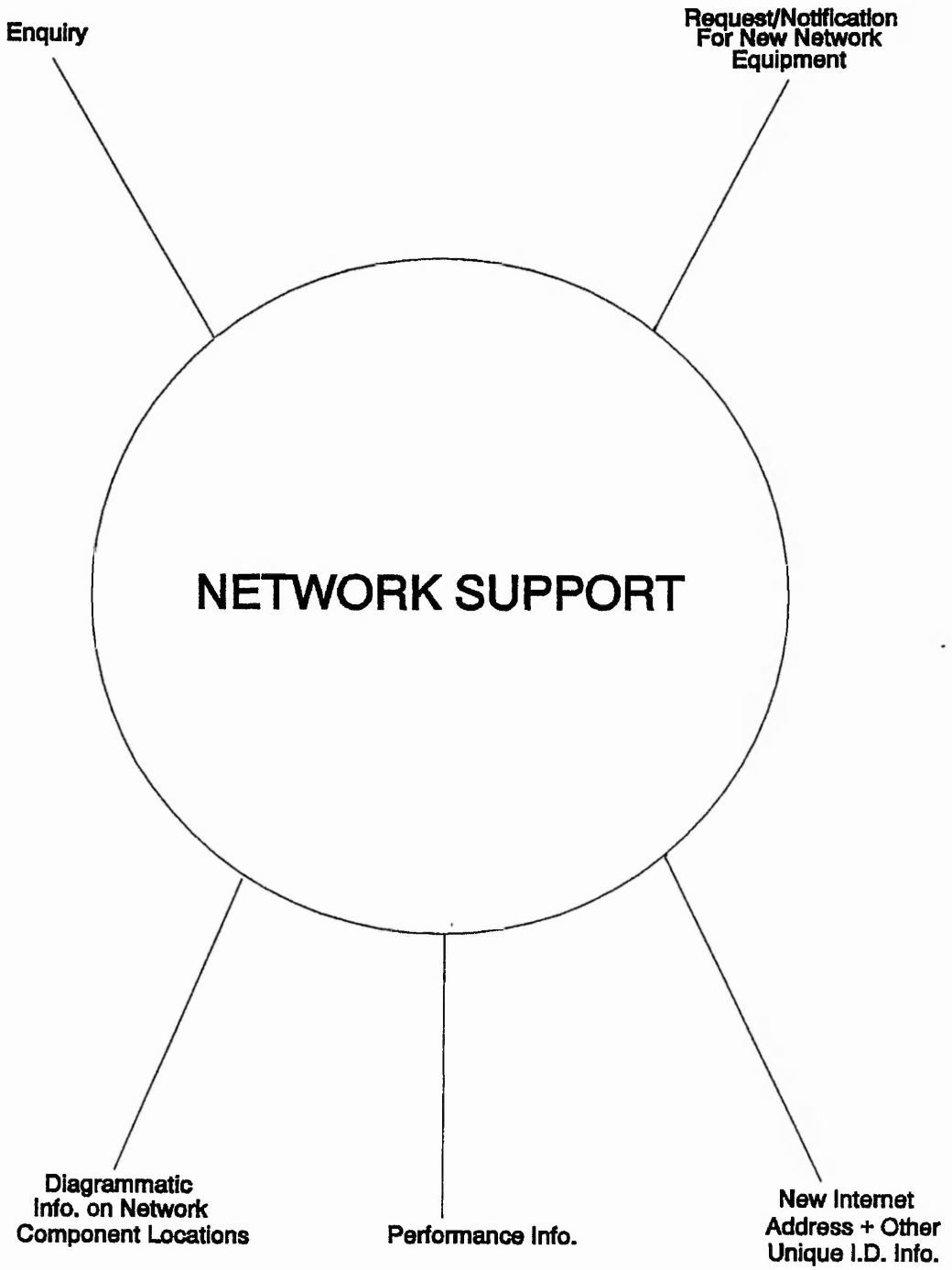
Information Flow within Help Desk

Figure 3.1



Information Flow within Expert System

Figure 3.2



Information Flow within Network Support

Figure 3.3

3.2.0 STATEMENT OF SOLUTION

A brief analysis of the problem areas highlighted in Chapter 1, shows that these problems can be categorised into four main areas of commonality, which are. . .

Help Desk; Expert Systems; Database; and Network support.

More detailed definitions of these areas/terms is given in Appendix F. However, a brief description is given here:

3.2.1 Help Desk

This term is given to a group of people who, depending on the company, have varying levels of computer expertise. This setup is not dis-similar to Information Centres and both work very closely with or on behalf of the Computer Services department.

Help desks are dedicated to assisting the users with any problems that may arise. Any problem that can not be dealt with by the Help Desk will be fielded (passed on) by the help desk to people who can deal with the problem. Thus, providing a single point of contact for the users and a guarantee that there will be always someone available (within the stated times) to deal with the original enquiry and any subsequent enquiry on the progress of any previous enquiry.

This help desk function off-loads the strain of dealing with less demanding or mundane tasks, such as reporting a faulty VDU, from other computer services staff.

3.2.2 Expert Systems

An Expert System is a computer assisted system which has built in knowledge of a particular subject area, which the user of it may not necessarily have, (possibly Help Desk staff), to be led through a series of questions or actions in a systematic way prompting for responses observed by the user. Decisions based on these user responses indicates the next best action to take until a solution is deduced. An example of its application is that of deducing a VDU fault for instance.

3.2.3 Database

"A database management system (DBMS) consists of a collection of interrelated data and a set of programs to access that data. The collection of data is usually referred to as a database. The primary goal of a DBMS is to provide an environment that is both convenient and efficient to use in retrieving information from and storing information into the database.". . ..G.2

Its application within this project is crucial to its success. All the information concerning the computer services department and its activities will have to be stored in a database. All other systems rely on accurate timely information provided by the DBMS, thus highlighting the importance of databases.

3.2.4 Network Support

As office automation increases so does the communications networks and with it the management and support of the network. There are many aspects of network management which if not coordinated and planned correctly can lead to very expensive mistakes. Network support includes the areas of implementation, maintenance, expansion, and administration.

3.3.0 CATEGORISATION OF PROBLEMS

The problems listed in Section 1.2.0 numbered 1 to 22, are categorised under one or more of the following headings:-

Help Desk	Expert System	Database	Network Support
-	-	2	-
3	3	-	-
4	4	-	-
-	-	6	6
7	-	7	-
-	-	8	8
9	9	9	-
-	-	11	11
-	-	-	12
13	-	13	-
-	-	14	14
-	-	15	-
-	-	16	-
-	-	17	17
-	-	18	18
19	-	-	-
20	-	20	-
21	-	-	-

It can be seen from the above table that there are some areas of overlap, where problem numbers occur more than once in a row. This indicates some level of integration between the different sub-systems in order that they meet their objectives. It is therefore proposed that the system to be developed to cope with these problems and the departmental requirements will be as the table (and project title) suggests, an integration of an Expert system; Help Desk; Database and Network support systems.

At the centre of the system is the database which will be used to solve the listed problems and act as a central source of data for the other sub-systems e.g. Help desk & Network support etc. which will be built upon/around this database.

The database is the most important system, to act as a base to build on and provide a common, standard and compatible interface to all the other systems.

If all data storage is controlled by the DBMS and thus all other systems use it then this will provide a form of Open System. That is, if the DBMS used is standardised upon, then any future developments, such as a computer consumable stock control system, will be able to interact with this or any other system no matter what platform the systems are running on.

A possible future development of the system proposed in this report would allow database entries concerning inventory of equipment be linked more closely with the stock control system.

The database will store, as indicated by the problem list, an inventory of all computer related products; hardware, software, configuration information, maintenance details, fault logging information, communication link details, and installation details etc.

The Help desk will access this database of information when required, for example to enquire on the fault status of particular item of equipment.

It will provide the necessary functionality via an easy to use menu & mouse driven system to make filling in of various forms, such as 'fault report sheets', as automated as possible.
Built into the Help Desk system will be the Expert system front-end which will enable low level fault calls reported to the help desk to be dealt with. This will take the form of leading the help desk staff down a systematic line of enquiry, e.g. first categorise the nature of the user call --> if it is a VDU fault, --> determine VDU type --> determine VDU symptoms --> depending on fault offer a set of steps to follow to cure the fault.

For future development, to avoid complicated update maintenance for this type of expert help, (due to the device dependant nature of it), some degree of artificial intelligence (AI) could be included so that as equipment changes, (and the corresponding faults associated with that device), so will the line of reasoning used, in order that the correct analysis of a problem is achieved.

The network support area solutions will be built around the database except for the monitoring of network performance. This can only be achieved by a separate sub-system either an in-house written or commercial software solution.

3.4.0 SOFTWARE PLATFORM

A central controlling system which will be menu, mouse and button driven look & feel, will integrate all the sub-systems named above. It is intended that the database be implemented in a relational database system with menu driven and ad-hoc enquiry facilities. A number of commercially available DBMS's have a number of associated add-on's which facilitate easy development, maintenance, report generation, data capture and overall ease of access to the database.

For these reasons such a DBMS will be chosen to develop the database and also the expert help desk & network support sub-systems, which have to interact closely with the DBMS, will be developed by the author using such products. A number of advantages can be gained by using this software development approach, as listed below:-

Advantages to using commercially available DBMS products
for software development

1) Development time can be reduced.
2) Improved integration with other systems through the standard interfaces provided.
3) Improved maintenance standards.
4) Training course available for these products.
5) Other programmers can understand the code since its written using a well defined 4th Generation Language (4GL), which is not necessarily the case with totally in-house 3GL written code.
6) Modular design.
7) Well tries and tested and therefore relatively bug free.

Some areas of implementation will be via other products such as network performance monitoring. This involves producing statistical information on network loads and usages. This will be collated from the network nodes and presented in an easy to understand form.

3.5.0 HARDWARE PLATFORM

For purposes of availability, reliability and portability the new system should be implemented on both PC MSDOS and Workstation UNIX platforms.

The overall solution will be a combination of window based software systems and a set of operational procedures and standards. The maintenance of the systems in terms of upto date information and software amendments, must be very quick, easy and reliable. Ease of access is important but without compromising security or integrity of the database. Taking a structured approach to this project and the resultant software system and procedures, (as discussed in numerous Bsc computer studies lectures), should enhance the final product.

3.6.0 HOW THE NEW SYSTEM WILL HELP

3.6.1 Benefits

1) Due to the high volume of transactions and data generated within the department it is essential that the department is not spending all its time performing administrative duties. Hence, a database system designed to cope with many of the different forms of administration will enable more efficient procedures for administration.

2) A large degree of automation will be involved in the storage & retrieval of hardware details, associated software details, maintenance, configuration and installation details. Thus, allowing quick, reliable access when required.

3) As with any system which involves many files, unless computerised, access to the information can be difficult, slow and error prone. Hence, this database system will provide easy user-friendly access.

4) If a systems information is not kept upto date then it falls into disrepute. This happens when

a) Procedures are not followed

b) High volume of data swamping resources

c) Difficult to use which leads onto (a) above.

Hence, a well designed database system will address these problems.

3.6.2 Costs

Due to the size and complexity of the area under study the investigation and analysis stages of this project are very time consuming and labour intensive. This causes some short term problems in terms of reduced man power and support to the users while the author concentrates on this project.

However, the cost of doing nothing is far greater in that Computer Resources will not be able to cope with the expected future works loads as the company expands.

3.7.0 COMMENTS

After recognition of the current and expected problems and requirements it was recommended that a thorough Investigation be undertaken to clarify the needs of the users and Computer Resources alike. To determine the size & scope of the project in terms of people, time, and money.

The categorisation of the problem areas was stated while further investigation examines the needs in each area and a list produced of information, operational, control, response, input/output and maintenance requirements as described in the following section. The feasibility, cost & benefits of a number of approaches/solutions are discussed in general terms.

3.8.0 LIST/OVERVIEW OF REQUIREMENTS

Computer Service's staff were interviewed in response to the project request, to determine what they viewed to be problem areas and future requirements within the scope of this project. Their responses were categorised under the same four headings described in chapter #1, Expert systems; Help desk; Database; and Network requirements, and summarised below in terms of Information, Operational, Control, Response, Input / Output and maintenance requirements:-

3.8.1 Help Desk

Operational requirements

a- Have phone manned at all times

b- Provide a single point of contact for all computer system related enquiries

c- Deal with initial calls within a fixed period (60 seconds say)

d- Categorise nature of call

e- Prioritise call

f- Action call request, which may take the form of. . .

. . . Field call if further help required

. . . Solve problems (via Expert system)

. . . Answer general questions

. . . Schedule Technical Support assistance

. . . Schedule on-site maintenance

. . . Progress and track faults previously reported

. . . Follow up on faults and solutions

g- Inform users of problems (unexpected or scheduled)

h- Be reliable

i- Appear efficient

k- Perform other duties such as. . .

. . . ordering of hardware & software

. . . computer consumables stock control

. . . progressing & monitoring of deliveries

l- Electronic transfer of fault report details directly to the section which will deal with the fault

m- Monitor performance of Help Desk

n- Monitor performance of Maintenance firms

o- Monitor performance of sections dealing with problems

p- Analysis & highlighting of recurring problems

Benefits

a- Someone will always be available to help with problems / enquiries i.e. a service is always available (within the published times)

b- Fault call / enquiries procedure easier for users if only one phone number to remember. Passing the user from one person to another is avoided.

c- To avoid missing a new call and not to inconvenience caller.

e- Prioritising call will offer better service to those calls which are more urgent by actioning the higher priority calls.

f- Calls are dealt with immediately by the Help Desk / Expert system for simple faults; or call is logged, reference number given to the caller and will be contacted by an expert; or call is fielded to the correct person, thus avoiding the user having to hang on the phone for too long or being passed to the wrong number.

g- Keeping users informed allows them to schedule their work more effectively, (a computer may be down for several hours); and prevents them from worrying due to uncertainty and eventually leading on to him/her ringing up Computer Services to find out, thus causing more hassle.

f&h- Fault calls are not forgotten & helps keep users informed by progressing

f&i- Fault calls are not mis-handled otherwise this will be intercepted when the user is asked "is everything ok?".

l- Avoids "chinese whispers" (messages getting jumbled) if EMail say is used (or fault sheets printed remotely and/or delivered to person). Fault message captured at source.

n&p - Due to the special maintenance contract BEM have with a particular company that maintain VDU's etc. BEM get a special discount in maintenance charges for every VDU the maintenance company are not called out to attend too. Thus, to ensure BEM are getting the correct discount some monitoring is required.

Dealing with calls more efficiently and quickly enables more problems to be solved and reduces 'down time' of the users productivity.

Information Requirements

a- Help desk will need to access a database of information regarding the site computer systems configurations. An inventory of hardware & software should be available with user identification details in order to cross reference the callers system details, (benefit of this is to make fault call procedures easier by avoiding confusion over what the system configuration really is, as is most often the case when the user does not know).

b- Help desk should identify the nature of the call. . .

. . . Enquiry

. . . New fault call

. . . Progressing previous fault calls

c- Further cross referencing of the database is required for fault calls e.g

. . . call up details of system that is at fault

. . . call up details of previous faults

. . . call up location details of user / equipment

. . . call up maintenance details

. . . log call

d- Identification details of available technical support staff who could deal with a fielded call.

e- Latest Computer Services news should be made available to the Help Desk e.g.

. . . Scheduled down time / maintenance

. . . Current unforseen problems

f- Information concerning status of a fault call or project (installation date etc)

g- Expected delivery dates for goods ordered etc.

h- Summary of calls to the help desk is to be kept and other relevant information in order to produce statistics of help desk performance.

i- Details of user fault calls for maintenance & response to these calls to be kept in order to monitor performance of service to the user & performance of the maintenance company.

Maintenance

- Database (db) to be kept upto date, such as
  - . . . Progress information
  - . . . Changes in procedures
  - . . . Telephones numbers
  - . . . Contacts
  - . . . Maintenance company details
  - . . . Fault information & their solutions entered into db.

Controls & Response

- Progressing of calls will need person performing the task to report back to help desk with progress information
- Must be a standby person to come in to man the phones (in the case of illness of heavy work load)
- Must be an easy way to identify category of calls
- Help desk must be kept informed, information concerning. . .
  - . . . Shutdowns
  - . . . Serious faults
  - . . . Delivery of goods information

- Availability of Technical Support staff and other resources must be known in order that help desk can field calls correctly & quickly and scheduling of assistance can be performed
- Logging of all call information & time spent on a call
- Person assigned to a problem must respond within a certain time, depending on priority of call
- Security & integrity of data within database and other systems must be maintained.

Input & Output methods

It is expected that either a PC or workstation (with attached VDU's) will be used.

Output devices located locally and/or remotely may be used to print fault action sheets, detailing

. . .

. . . people to attend to a fault

. . . details of the fault

. . . location & contact name & phone number

. . . priority of call

These output devices may be printers and/or a window on a workstation, (Email).

Suggested methods of contact to the help desk are. . .

. . . Phone

. . . memos

. . . scheduled appointments

. . . Email

. . . Fax

3.8.2 Expert Systems

Operational Requirements

- For a fault the category under which it falls will determine the sequence of actions / procedures to follow in order to establish the solution.
- Enquiries for a recommended hardware / software configuration will prompt for particular requirements and respond accordingly with perhaps a choice of existing systems and history of any faults which may of occurred and history of modifications / upgrades. Associated reasons for these faults / modifications will indicate how successful this configuration has been.
- Future requirements may include an expert system which will update its own procedures and fault finding reasoning when equipment is changed / modified.

Information Requirements

- Part of fault finding process requires status information from various systems eg. To determine if a 'console is disabled' on a Data General (DG) mainframe.
- Access to the database is required to determine hardware and/or software specifications etc. of faulty items.
- Access to the database is required to access. . .
  . . . History records
  . . . Installation records
  . . . Configuration records

When searching for system specifications to match a new requirement in order that the most successful system is recommended.

- Sufficient information from the user to establish nature of call

Input / Output Requirements

- Access to other systems such as the DG mainframes is required to pursue solutions on these systems e.g Enable a console or password changes

- Menu driven access only to some systems in order to restrict access to secure systems

Controls

- Security of systems is essential, particularly when access is required to them to establish status and/or fix problems.
- Password changes must be controlled very carefully

Response

If fault correction is going to be time consuming then call should be logged and user re-contacted.

3.8.3 Database System

Operational Requirements

- Easy to use method of enquiring, outputting, updating, entering and deleting records for all entities of the database
- Expert Help Desk and Network sub-systems to use database facilities as human interface, thus reducing the need to train users on more than one system.
- Reduce clerical and manual duties
- Support all sub-system requirements

Information Requirements

- Records on the following entities are required. . .
  - . . . Hardware (including peripherals)
  - . . . Software
  - . . . Communication configurations (serial / network / wiring)
  - . . . Installation
  - . . . Lease and Acquisition details
  - . . . Maintenance details
  - . . . Invoice details
  - . . . User details
  - . . . Fault history

Control

Only authorised personnel should have access to the database. Control access via 2 levels of username / password protection.

Input / Output

All access is performed via menu driven and 'look & feel' windowed type screen displays.

3.8.4 Network Support

Operational Requirements

- Standardise on network node configurations and provide a system to allocate the following node identification information when systems are installed . . .
  - . . . Internet Address (Network number + Host id number)
  - . . . User id numbers
  - . . . User group names
  - . . . User group id numbers
  - . . . HOST names
  - . . . Network Information Services (SUN's NIS) Names

- Provide tabular / a diagrammatic logical view of the location and interconnection of ...
  - . . . network nodes
  - . . . network components
  - . . . cabling
  - . . . network attachment points

- To aid planning of distributed systems, provide information on . . .
  - . . . network cabling lengths
  - . . . cable / link media
  - . . . network traffic loads
  - . . . network performance between nodes and along segments

- Highlight performance problem areas in terms of segment and node loads

Controls

- Standardise on a company network class
- Server HOST names to be meaningful in terms of its location in the company
- LAN node HOST names to be user friendly
- Associate particular network identification groups to particular devices

- To facilitate Email communications between remote nodes, a "Post Office" designated machine should provide identification & location details of the machines "on its round". The Post Office nodes will be a form of server. The user will request to send mail. . . systems responds with a list of "post offices" whose name corresponds to its physical location in the company. . . user selects area. . . system responds with a list of machines on its "post office delivery round" and associated user & location details. . . user selects which user he is going to send Email to. . . and the message is sent.

Information requirements

The physical location of network equipment and cabling is a problem in that no records have been kept during previous installations. When expanding / modifying a section of a network it is vital to know what the existing section of the network consists of and where it is located. The database system will organise and store network information such as. . .

. . . Inventory of network components

. . . Location of equipment

. . . Location of cabling

- Access to the database to enquire / update network configuration details for a particular computer say, including details on software used etc.

Input / Output requirements

Must be easy to enter and maintain network map and component details into the database.

It must be pointed out that although the results of the investigation into the perceived requirements are all listed above, it does not necessarily mean that all of them are recommended or within the scope of this report.

3.9.0 DATABASE DESIGN

In developing a database to store this information a number of other issues have to considered in order that any future development will be as easy as possible.

3.9.1 Hardware Inventory Considerations

Other than the usual details required about a particular hardware item or peripheral such as make, model, and serial number there are many potential complications depending on the type of item, especially in the case of communication links. There are 2 views of peripheral inventory information.

First . . . details concerning the peripheral itself and its location

Second. . . its utilisation and details of any communication lines attached to it and the corresponding computer system at the other end.

(a) A computer has 1 or more serial line connections through which. . .

. . . 1 VDU may be connected directly to 1 computer OR

. . . 1 VDU may be connected to 2 or more computers via a data switch, (which in turn will be connected to 2 or more corresponding serial lines)

. . . 2 or more VDU's may be connected to 1 computer via a data switch

(b) A computer may have a network connection connected to which may be any number of. . .

. . . related peripheral devices (laser printers, comm's devices etc)

. . . related computer systems

. . . associated file server

. . . associated clients

. . . unrelated devices

A computer system has many items of hardware associated with it. These items can be categorised into distinct groups. First there is the hardware necessary for a computer to function. . .

. . . internal components (memory; network cards; disk)

. . . external components (disk; tape; master console)

. . . such as the memory, disk and other input and output devices. Second, there are the peripherals which are attached to the computer which provides a system that will provide the necessary functionality and services to meet the goals and objectives of the system.

These peripherals take the form of. . .

. . . input (keyboards, light pens, scanners)

. . . output (screen, printer, plotter)

. . . input & output (VDU's, terminals, modems)

To attach these peripherals either (a) or (b), as above, or both may be employed. A number of communication devices exist to allow this level of connectivity such as. . .

. . . modems

. . . line drivers

. . . multiplexers (port selector or intelligent MUX)

. . . data switch (as already introduced)

which utilise more efficiently the serial lines to the computer.

Network devices are used such as. . .

. . . Transceivers (TXR)

. . . direct BNC connections

. . . direct (attachment unit interface) AUI connections

. . . (radio frequency) RF connections

3.9.2 Summary of Hardware Considerations

A computer has 1 or more serial line connections through which. . .

. . . 1 VDU may be connected directly to 1 computer OR

. . . 1 VDU may be connected to 2 or more computers via a data switch, (which in turn will be connected to 2 or more corresponding serial lines)

. . . 2 or more VDU's may be connected to 1 computer via a data switch

. . . A VDU, workstation, or PC may be connected to a port selector (MUX) which in turn is connected to many computer ports (asynchronous lines).

. . . A modem may be connected to 1 computer port

. . . An input device may be connected to 1 computer port

. . . An output device may be connected to 1 computer port

. . . A VDU, workstation or PC may be connected to one or more devices

All of the above considerations and those mentioned earlier under each of the headings of Help Desk, Expert System, Network and Database systems are modelled diagrammatically in the following chapter using Entity-Relationship Diagramming. This model will serve as the structure of the whole system.

CHAPTER 4

SOFTWARE DESIGN & DEVELOPMENT

4.0.0. SOFTWARE DESIGN AND DEVELOPMENT

4.1.0 POSSIBLE APPROACHES/SOLUTIONS

The key decisions to make during new system selection are:

. . . Determine the Requirement;

. . . Software which will meet the requirement;

. . . Hardware that will support the Software;

. . . the Supplier of the hardware & software;

. . . and the price.

. . . (in that order!).

At this point in the report a fairly accurate picture has been developed of the system requirements for both the short and long term. Although this project will focus on the short to medium term implementation the long term requirements have to be kept in mind for reasons of flexibility, compatibility, and upgradeability.

The following section looks at the software and hardware which will form the base of the new system.

4.2.0 SOFTWARE CONSIDERATIONS

Considering the database first, since it is at the heart of the system, there are 2 main choices in keeping with the company and departmental strategies. They are:-

. . . dBASE IV running under MSDOS on PC's

. . . Oracle 4GL running under either MSDOS or UNIX

dBASE IV has a bad reputation in terms of software bugs and performance. Also, as stated previously a **true** relational database management system (RDBMS) is required, which dBASE does not offer.

Oracle is chosen as the database system to be used for the following reasons:-

- . . . Oracle has a very good reputation in terms of performance & bugs
- . . . Oracle provides a number of products (add-ons) which provide the necessary functionality required as stated in the requirements specification such as . . .
  - . . . Pro*C
  - . . . Sql*Forms
- . . . Oracle is a true relational database system.
- . . . Oracle is part of the authors 3rd year syllabus
- . . . Oracle is the standard for large systems

4.2.1 Justification of Oracle Add-ons

SQL*forms makes it easy to work with the information in an Oracle RDBMS. Once a form is designed, operators can use it much like they would a conventional paper form. Forms can be simple and basic or complex and sophisticated, checking and facilitating the operator's work in many ways. Complex forms consist of 'triggers' which are a small set of commands which allows relative complex operations to be performed, or provide a mechanism to call a 3GL program or a Pro*C system, (see below). SQL*forms is one of several products which can be used to store, change, retrieve and work with information in an Oracle database. SQL*forms allows interaction with the RDBMS via electronic forms.

4.2.2 Advantages to SQL*Forms

These forms provide fast and easy data entry, updates, deletions, and queries to an Oracle database. SQL*forms gives the ability to . . .

- . . . insert data into the database by typing the data directly into fields displayed on the screen
- . . . view, update, or delete several records on the screen at one time
- . . . type query conditions directly into the fields that are to be queried.

(Authors note: This description of 'forms' meets some of the most important prime requirements specified earlier in this report! For a full description of SQL*forms see APPENDIX G for references).

4.2.3 Pro*C

Oracle provides two programmatic interfaces for application programmers. The first, and perhaps the most efficient for developing an application, is the pre-compiler interface. By using the pre-compiler interface, it is possible to write an application in a high-level language (such as C) that contains embedded statements written in SQL statements. Using Pro*C pre-compiler enables application programmers to combine the most appropriate features of both C and SQL in a single application.

The importance of Pro*C here is that it can be executed from within a 'form' when more complex processing is required.

4.2.4 Expert System Implementation

Through the use of Pro*C and SQL*Forms all the major elements of the required system can be developed and at the same time are inherently integrated with the RDBMS. For example, the Help Desk functions can easily be implemented in SQL*forms and seems to be little reason to do it any other way. However, the Expert system front end which is so closely linked to the help desk could be implemented in a number of ways such as. . .

. . . Crystal expert shell

. . . in-house written rule based system

In order to be consistent and improve the integration with the Oracle database the expert system will be implemented using SQL*forms and in-house written macros, to be executed when triggered (see forms), which will enhance the power of SQL*forms. Expert system programs written using 'Crystal' say are not much more than a very large set of 'If . . . Then . . . Else. . .' statements when relatively simple procedures are to be produced, as is the case here. Crystal offers a system which makes it very simple and structured to write in this style of 'IF . . . AND. . . IF . . . THEN . . . ELSE. . .' Hence, this can easily be implemented in 'C' routines and/or SQL*forms.

The network support sub-system again will be implemented in SQL*forms for all the administration functions. However,the performance monitoring functions can not. During the course of this project a new product came onto the market which meet all the requirements specified for network performance management. This product, SUN*NET manager, has been evaluated at length by the author and will be installed on a trial basis when finances allow.

4.3.0 HARDWARE CONSIDERATIONS

In order that the network sub-systems and the help desk Email facility be implemented then a machine networked to the company broadband will be required to run the system designed during this project. In align with company policy there are 2 alternative computer systems that could be used:

- . . . IBM compatible PC, ICL M55 386 SX running MSDOS
- . . . UNIX workstation, SUN SPARC running SUNOS UNIX

Both of these systems are capable of running the Oracle RDBMS, and being connected to the network. However, the SUN SPARC system will be used as the platform for development for the following reasons:-

- . . . SUN is Oracle's platform for their RDBMS
- . . . Workstations are the company standard for the implementation of large database systems such as Oracle
- . . . UNIX is emerging as the standard for office automation systems (see APPENDIX U for details)
- . . . The workstation offers much better performance in terms of CPU power, response times, multitasking, multiuser, and screen display facilities and at a price not much more than that of the PC with a similar configuration. Most SUN workstations can support 40+ Oracle applications.

. . . The SUN workstation can be upgraded to a much higher specification if ever required

. . . SUN workstations have proven to be highly reliable (an essential pre-requisite) at BEM (approximately 100 installed on site).

. . . The SUN workstation features a number of in-built network monitoring systems, and has network connections, Email and a 'C' compiler as standard. The PC does not.

. . . The workstation has enough power to support several X-terminals (see later section)

The number of people capable of accessing the system can be increased in one of several ways:

. . . 2 VDU's connected via the 2 serial ports on the workstation

. . . clients on the network

Thus making it easy to access the system from a number of different areas and allowing Email.

4.4.0 FEASIBILITY STUDY

4.4.1 Operational Feasibility

Q: Is there sufficient management support for this project?

A: All managers are very keen on a help desk system and are aware of the operational difficulties within the Computer Services department

Q: Is there sufficient user support?

A: All members of Technical Support and other key members are also keen and aware of the benefits of a system which will alleviate the problems highlighted in this project

Q: Resistance to change to old system?

A: There is no formal existing system to speak of and therefore you can not resist change to a non-existent system. However, any disruption to peoples fixed ways will normally bring some criticism and objections. But as long as this project is "sold" to all concerned by making everyone aware of the expected benefits, and also how the system is expected to operate, at an early stage, then if there are any objections these can be addressed. However, this does not appear to be a problem.

Q: Current business methods acceptable to users?

A: No. As explained earlier, the current system, as little of it as there is, is not very efficient therefore a change would be welcome.

Users have been kept informed of progress, and asked to make comments, recommendations and help construct this new system. The only foreseeable problem would be that of having to learn to trust the help desk system and/or its staff, but this will be taken care of during training. Other problems concern finding the time to learn to use any new system.

4.4.2 Technical Feasibility

Q: Is the right equipment available?

A: The system on which this project will be developed was specified by the author and should be delivered by Mon-17-Dec-90. See APPENDIX V for the technical specification.

Q: Accuracy & response of system?

A: Response will be no problem whatsoever. The accuracy of the system will be as accurate as the design and implementation of the software will allow. The hardware & software platforms proposed has proven reliability, ease of access via network facilities, and the suppliers of these platforms have a good reputation for after sales support. An incentive for this continued support is the amount of money BEM already spend with them!

Q: Security?

A: Limiting access via a network using standard procedures should be enough. However, UNIX systems have a poor reputation in this respect but a number of methods developed in-house and inbuilt will meet the security requirements, eg. C2 security can easily be installed on the SUN workstation.

4.4.3 Financial Feasibility

Q: Cost of investigation?

A: Mainly in terms of reduced man power while the author is away from BEM. This is of major concern to BEM since manning levels are already very low and work load very high. During the course of this project 2 weeks un-paid holiday plus whole of the 1991 holiday entitlement were used up between 1-1-91 and 1-4-91. This has caused a lot of inconvenience to BEM.

Q: Cost of hardware & software?

A: £18000 of SUN equipment; £20000 of software (Oracle RDBMS)

The system does appear to be feasible in all the 3 above areas.

4.5.0 COST & BENEFITS

4.5.1 Benefits

1) Due to the high volume of transactions and data generated within the department it is essential that the department is not spending all its time performing administrative duties. Hence, a database system designed to cope with many of the different forms of administration will enable more efficient procedures for administration.

2) A large degree of automation will be involved in the storage & retrieval of hardware details, associated software details, maintenance, configuration and installation details. Thus, allowing quick, reliable access when required.

3) As with any system which involves many files, unless computerised, access to the information can be difficult, slow and error prone. Hence, this database system will provide easy user-friendly access.

4) If a systems information is not kept upto date then it falls into disrepute. This happens when

   a) Procedures are not followed

   b) High volume of data swamping resources

   c) Difficult to use which leads onto (a) above.

   Hence, a well designed database system will address these problems.

5) Improved response to the users

6) Improved image

7) Improved job satisfaction (less paper pushing)

8) A chance to be 1 step ahead of the competition.

4.5.2 Costs

1) Due to the size and complexity of the area under study the investigation and analysis stages of this project are very time consuming and labour intensive. This causes some short term problems in terms of reduced man power and support to the users while the author concentrates on this project.

However, the cost of doing nothing is far greater in that Computer Resources will not be able to cope with the expected future works loads as the company expands.

2) 70 man hours to collect data from all items of equipment and products

3) 35 man hours to enter database data

4.6.0 COMMENTS

To maximise reliability there will be a degree of redundancy in terms of standby PC's or workstations. However, this highlights one of only a few disadvantage of using workstation, that is, it would be too costly to have spare workstations lying idle. When faults do occur it is usually the disk, thus all that is required as an optimum solution is a spare disk unit. Backups are completed every night and thus a full restore onto the spare disk is possible.

Developing the system using Oracle allows for very portable systems thus increasing availability of the system.

4.7.0 POSSIBLE PROBLEM AREAS

- keeping the expert system upto date
- maintenance of data
- network map initialisation; entering component details & locations etc
- database input; huge amounts of data to be entered eg. serial connection details
- keeping help desk informed of fault status / progress

4.8.0 DATABASE DESIGN

In developing a database to store this information a number of other issues have to considered in order that any future development will be as easy as possible and all information requirements are met.

4.9.0 HARDWARE INVENTORY CONSIDERATIONS

Other than the usual details required about a particular hardware item or peripheral such as make, model, and serial number there are many potential complications depending on the type of item, especially in the case of communication links. There are 2 views of peripheral inventory information.

First. . . details concerning the peripheral itself and its location

Second. . . its utilisation and details of any communication lines attached to it and the corresponding computer system at the other end.

a) A computer has 1 or more serial line connections through which. . .

. . . 1 VDU may be connected directly to 1 computer OR

. . . 1 VDU may be connected to 2 or more computers via a data switch, (which in turn will be connected to 2 or more corresponding serial lines)

. . . 2 or more VDU's may be connected to 1 computer via a data switch

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. . . related peripheral devices (laser printers, comm's devices etc)

. . . related computer systems

. . . associated file server

. . . associated clients

. . . unrelated devices

A computer system has many items of hardware associated with it. These items can be categorised into distinct groups. First there is the hardware necessary for a computer to function. . .

. . . internal components (memory; network cards; disk).

. . . external components (disk; tape; master console).

. . . such as the memory, disk and other input and output devices. Second, there are the peripherals which are attached to the computer which provides a system that will provide the necessary functionality and services to meet the goals and objectives of the system.

These peripherals take the form of. . .

. . . input (keyboards, light pens, scanners)

. . . output (screen, printer, plotter)

. . . input & output (VDU's, terminals, modems)

To attach these peripherals either (a) or (b), as above, or both may be employed. A number of communication devices exist to allow this level of connectivity such as. . .

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. . . line drivers

. . . multiplexers (port selector or intelligent MUX)

. . . data switch (as already introduced)

which utilise more efficiently the serial lines to the computer.

Network devices are used such as. . .

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. . . A VDU, workstation, or PC may be connected to a port selector (MUX) which in turn is connected to many computer ports (asynchronous lines).

. . . A modem may be connected to 1 computer port

. . . An input device may be connected to 1 computer port

. . . An output device may be connected to 1 computer port

. . . A VDU, workstation or PC may be connected to one or more devices

4.9.2 The following figures represent the database model upon which the new system is implemented.

Figure 4.1 is the Entity Relationship Diagram which models all relationships between all entities other than the maintenance, installation, lease, fault and user-information entities which are modelled separately in Figures 4.2 - 4.6 for clarity.

E.R. DIAGRAM

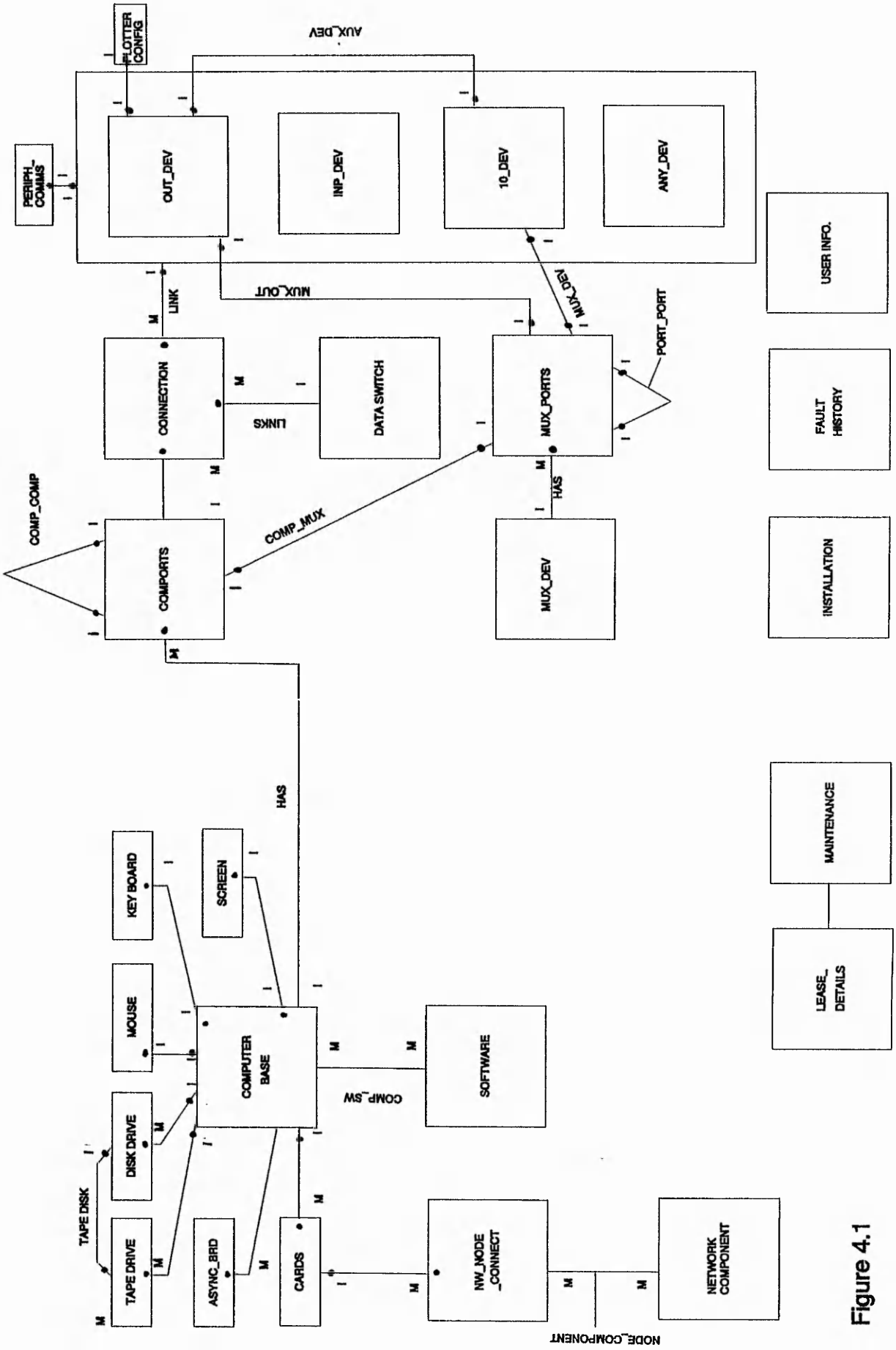


Figure 4.1

Figure 4.1

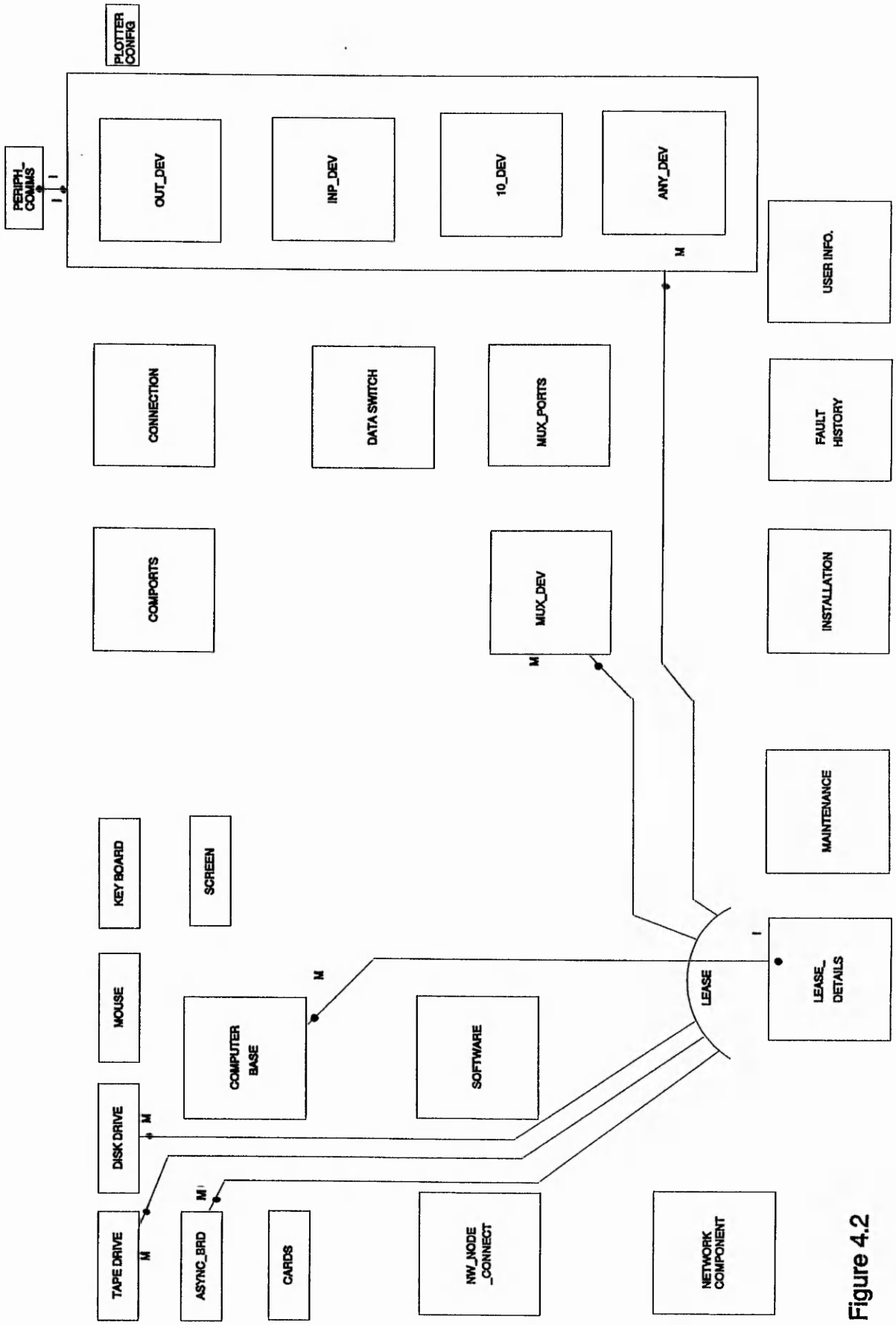

PLOTTER CONFIG
PERIPH_ COMMS
OUT_DEV
INP_DEV
IO_DEV
ANY_DEV
USER INFO.
CONNECTION
DATA SWITCH
MUX_PORTS
FAULT HISTORY
COMPORTS
MUX_DEV
INSTALLATION
MAINTENANCE
KEY BOARD
SCREEN
MOUSE
COMPUTER BASE
SOFTWARE
LEASE
LEASE_ DETAILS
DISK DRIVE
TAPE DRIVE
ASYNC_BRD
CARDS
NW_NODE _CONNECT
NETWORK COMPONENT

Figure 4.2

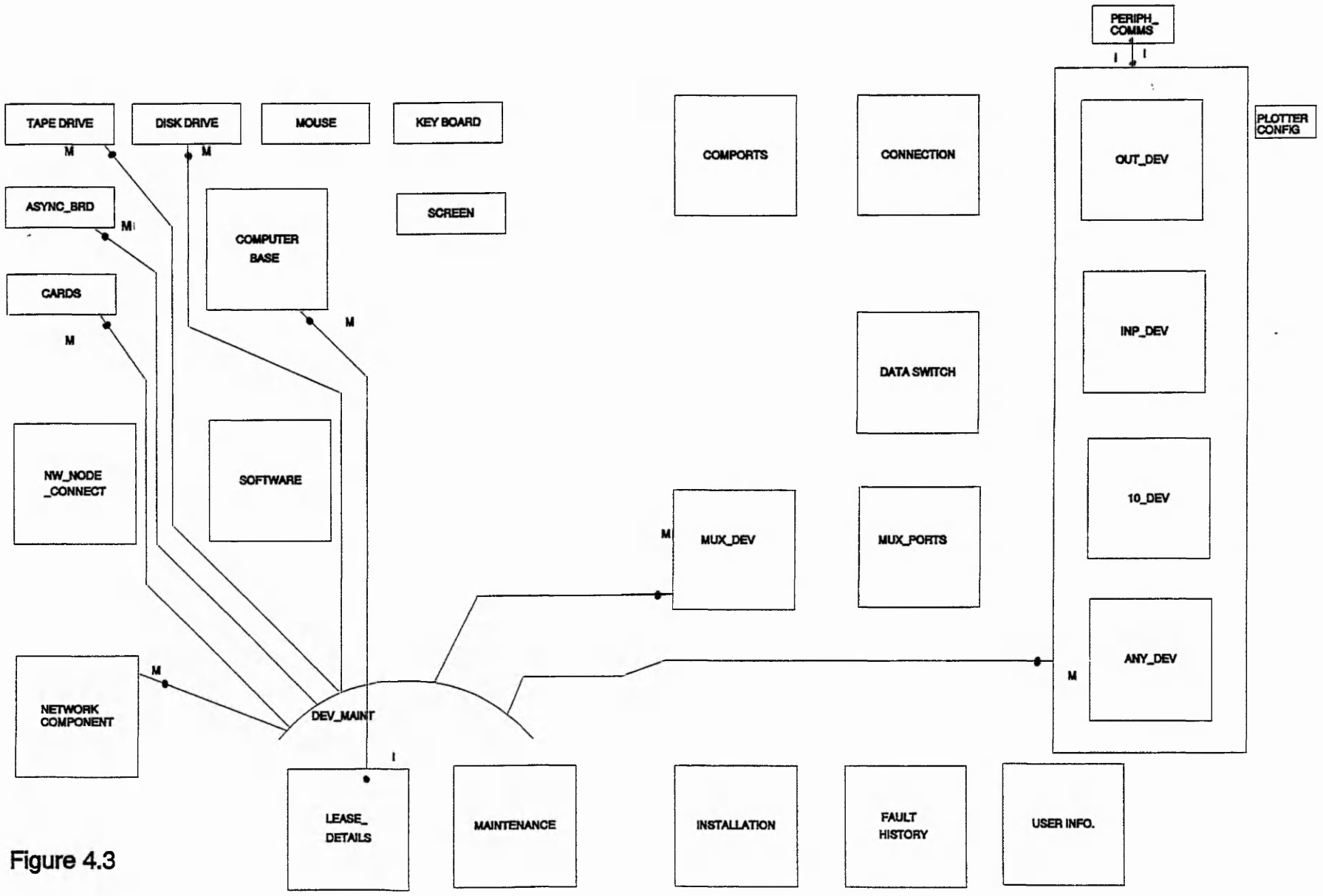
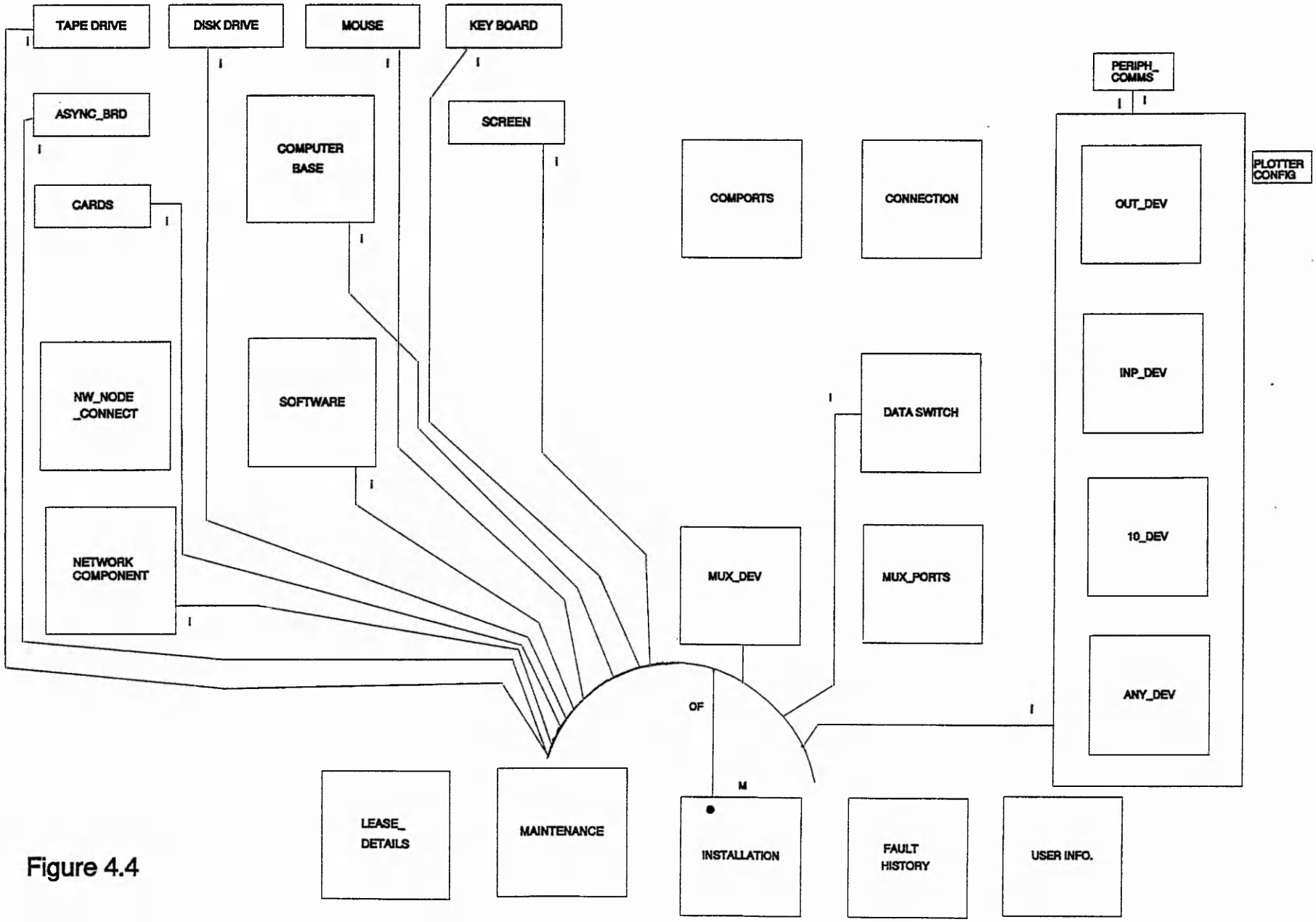


Figure 4.3

Figure 4.3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SOFTWARE
DATA SWITCH
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INSTALLATION
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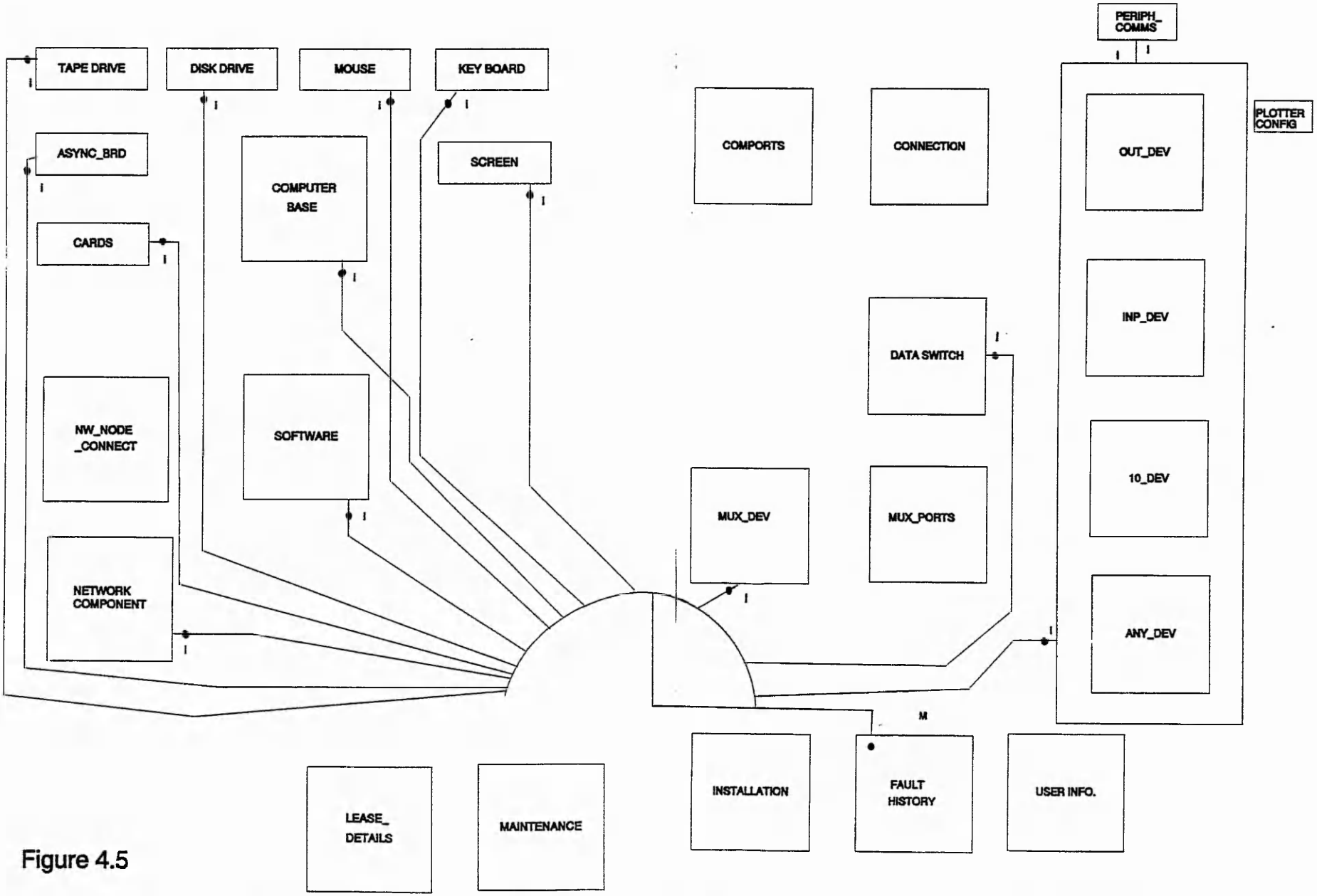
USER INFO.

Figure 4.4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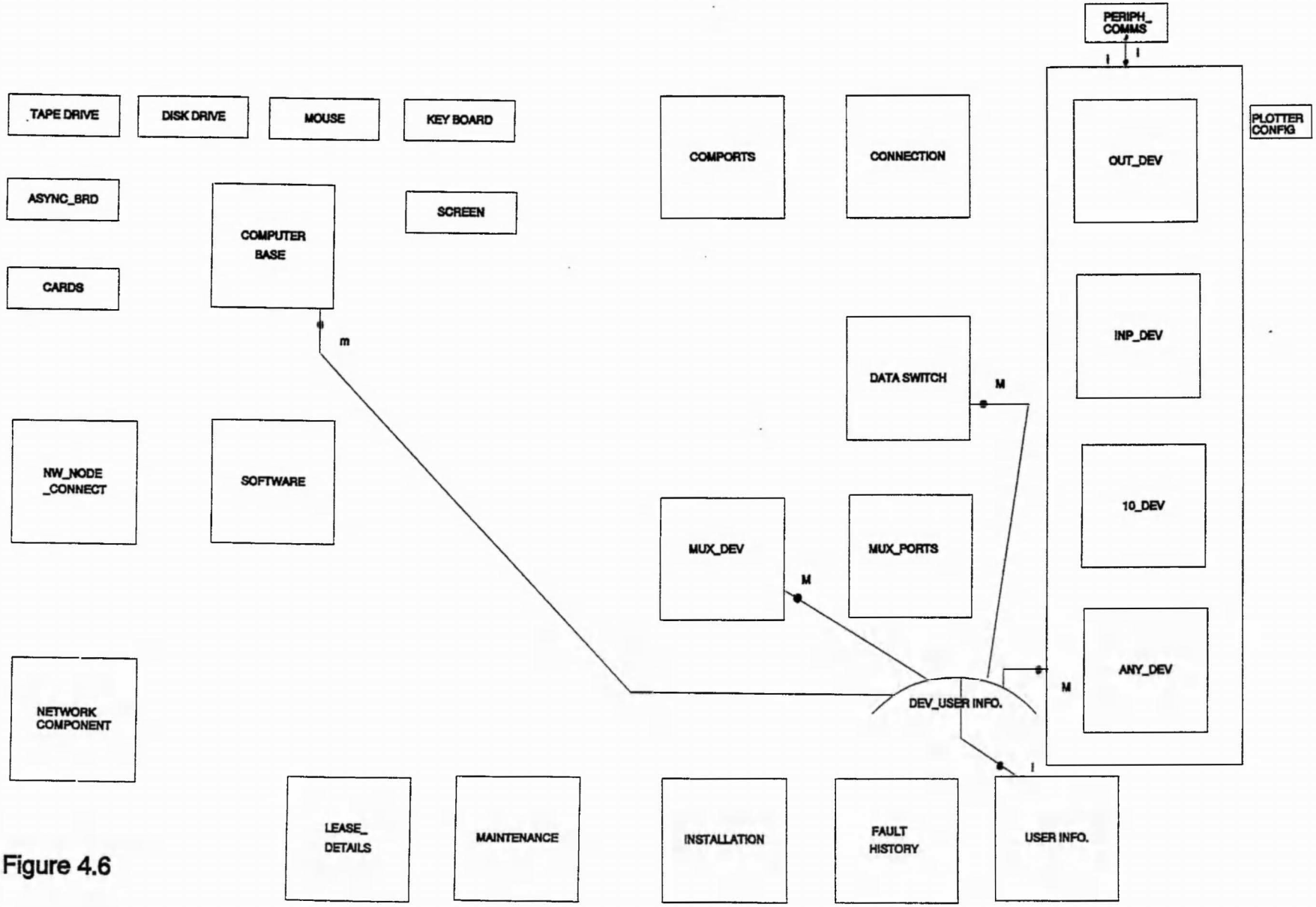
USER INFO.
LEASE_ DETAILS
MAINTENANCE

Figure 4.5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DATA SWITCH
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MUX_DEV
MUX_PORTS
M
ANY_DEV
M
DEV_USER INFO.
LEASE_ DETAILS
MAINTENANCE
INSTALLATION
FAULT HISTORY
USER INFO.

Figure 4.6

4.10.0 EXPERT SYSTEM DESIGN

As already discussed, the expert sub-system is to be built upon the DBMS using the SQL*forms product as the tool for design and implementation of the expert front-end system to the help desk, also implemented using SQL*forms. This provides a high degree of integrity and also a number of labour saving tools as part of the package.

All expert systems conform to the generic structure given in Figure 4.7 and its description is as follows:

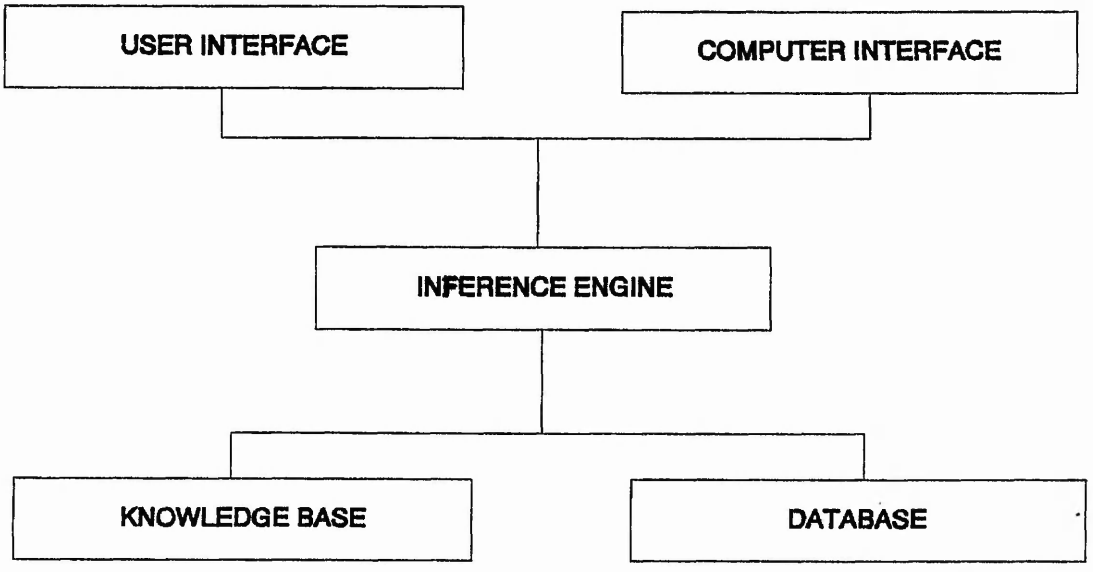
The expert system's database contains fixed items of data which are used in some interactions.

The knowledge base consists of rules that represent the organised knowledge of the domain in question. The rules are written in the form of logical boolean type operations as in Figure 4.8.

The data input by the user, computer interfaces and data generated during the interaction are placed in the database so that there is a record of the interaction. The inference engine is a computer program that selects which of the rules within the knowledge base should be selected for evaluation and interprets the rules in light of the data supplied, and provides conclusions.

The user and computer interfaces are means of loading data into the expert system database. This data is entered by the user via easily understood screen formats on a VDU.

The interfaces in Figure 4.7 as mentioned above will be implemented in SQL*forms, the database will be Oracle's RDBMS, the inference engine based on SQL*forms 'event triggers' and the knowledge base will be logical operations implemented within the 'trigger' macros.



Generic Expert System Structure

(Source G.20)

Figure 4.7

IF the VDU is a TATUNG

AND the ERROR_MESSAGE is 04

THEN perform SETUP

Typical Knowledge Base Rule

Figure 4.8

4.11.0 DESIGN OF HARDWARE FAULT FINDING SYSTEM

There are many different items of hardware each of which can develop faults which when reported to Computer Resources are currently dealt with by the relevant area, eg. Technical Support deal with approximately 99% of the hardware fault calls. The fault may be dealt with in one of the following ways:

- . . . Technical Support visit the problem area
- . . . Technical Support deal with the problem over the phone
- . . . Technical Support contact a third party maintenance firm to attend to the fault
- . . . Technical Support refers the fault to another department who have the necessary experience or knowledge best suited for this particular fault eg. Applications department

To complicate matters more, a hardware item belonging to a particular category eg. a VDU, PRINTER, etc. can be very different from another item in the same category and as such have their own specific potential problems. Thus, for each type of problem or hardware item there is a corresponding set of steps to follow to cure the fault.

The majority of fault calls concern VDU's. The reasons for this are that the majority of hardware items used are VDU's approximately 300+ some of which were installed many years ago and are less reliable than todays computer equipment. Also, VDU's are mostly installed in very hostile environments such as on the shop floor (oily, dusty, damp etc).

The following is a brief list of the types of VDU fault that are reported regularly:-

- . . . screen display frozen
- . . . screen display distorted (fuzzy, breaking up, lines appearing etc)
- . . . keyboard is dead
- . . . screen display is blank / dead
- . . . VDU is disabled
- . . . keyboard does not operate correctly
- . . . error messages displayed
- . . . etc. . .

A number of these faults are caused by, or because of . . .

. . . user ignorance

. . . user mistakes

. . . user accidents

. . . lack of training

. . . user misperception

. . . lack of simple checks

. . . physical hardware item failure

. . . physical communication line breaks

. . . computer system to which VDU is attached is 'down' ((un)expected)

. . . software problems

. . . computer system running slowly

. . . etc . . .

The majority of fault calls received are of the 'user at error' type or faults which require very little Technical Support interaction to cure eg. pressing a single key to cure the fault.

(N.B. The following describes in detail one of the potential problem areas, its cause and its solution: All VDU's communicate using 'software handshaking' XON/XOFF or CTRL Q/CTRL S protocols. This allows the VDU and computer system to START & STOP the transmission of data so that data is not lost if one of these devices can not deal with the data quickly enough. There is also a key combination on all keyboards which can generate the same signals CTRL Q / CTRL S which can be used to stop data scrolling off the screen. Sometimes electrical disturbances (noise) on the communications line can generate a CTRL S signal. What all this means is that accidentally or otherwise a users VDU may lock up and Technical Support deal with the problem by generating a CTRL Q in one of many ways to solve the problem.)

During the fault finding process the user interacts with Technical Support in that. . .

. . . Technical Support perform **local** checks

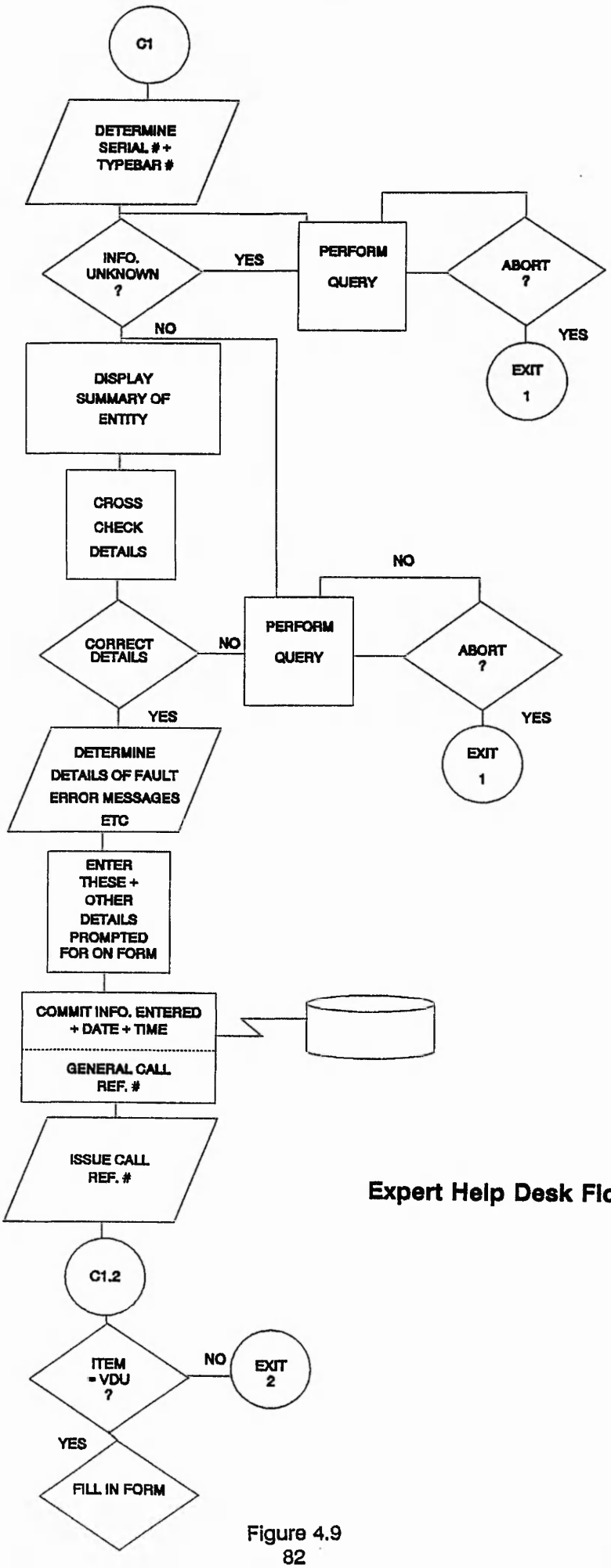
. . . Technical Support perform **local** actions

. . . The **user** is asked to perform checks and feedback response / status

. . . The **user** is asked to perform certain actions

4.12.0 OVERKILL METHODOLOGY

The author has analyzed the types of fault and their cures and has devised a universal system of **user** and **local** checks and the appropriate corresponding actions to take, which can be applied to all the different types of VDU etc. Although these actions and method will not necessarily be as accurate at establishing the cause of the original problem it will cure the problem more quickly and with as little hassle as possible, thus allowing the user to continue with more important company business. Also, having less device specific details or 'rules' reduces future maintenance requirements. However, some device specific checks & actions are made where the benefits are greatest.



Expert Help Desk Flow Chart

Figure 4.9

Expert Help Desk Flow Chart (Contd)

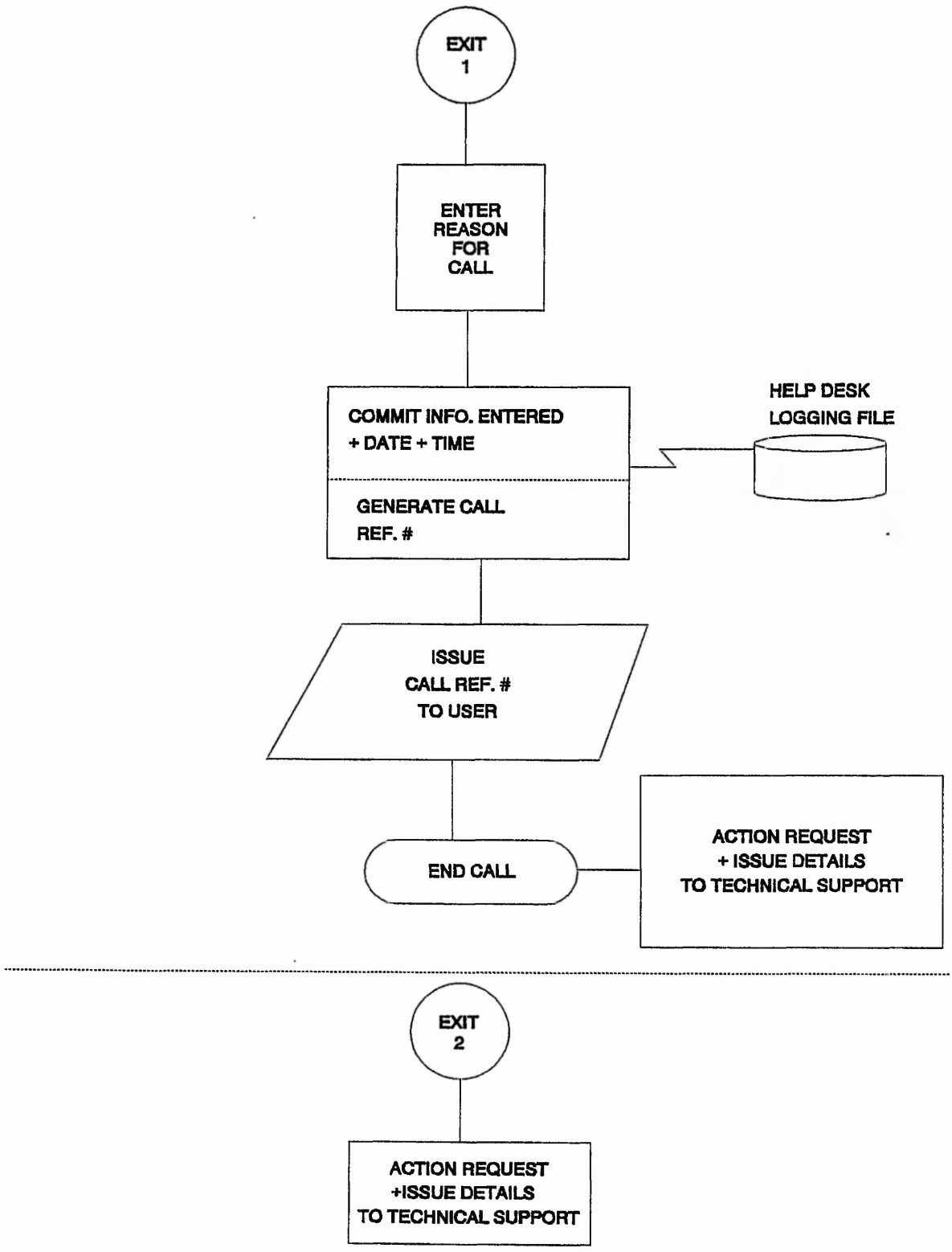


Figure 4.10

CHAPTER 5

SUPPORT SYSTEM IMPLEMENTATION - RESULTS

5.0.0 SUPPORT SYSTEM IMPLEMENTATION - RESULTS

5.1.0 HARDWARE IMPLEMENTATION DETAILS

The support system is implemented on a SUN SPARC workstation with the following technical specification:-

RISC based SPARC 1+ (4/65), 17 mips

669MB external scsi disk

150MB external scsi tape drive

16MB main memory

16" Hi-resolution colour monitor

Optical mouse

Internal 3.5" DOS compatible disk drive

This machine is connected via a 'Cabletron' transceiver to the company wide broadband network.

Backups of all data is achieved via an Exa-byte tape drive connected to another SUN workstation on the network. The disk is dumped across the network to this 2.3GB, 8mm video tape cartridge every night, (a UNIX c-shell script written by the author performs this automatically).

5.2.0 SOFTWARE IMPLEMENTATION DETAILS

The following software is loaded onto this machine in order to implement the system:-

- SUNOS 4.1.1 (UNIX operating system, compatible with OSF system 5.4)
- Full Oracle RDBMS version 6 (including SQL*forms etc)
- Openwindows 2 (X windowing system)
- Sunview (standard Sun windowing system)
- C compiler (Ansi standard)
- TCP/IP (Ethernet networking protocol)
- SunNet Manager
- DOS windows
- PC-NFS (on PC clients)

SQL*forms only works in a window environment such as 'Sunview' or if the X environment is required, providing X11 compatibility, then 'Openwindows' will be used. SunNet Manager only works in a window environment also. Remote systems, such as PC's, can access this new system via PC-NFS which can mount file systems over the network so that the workstation disk 'appears' to be local to the PC!

5.3.0 SYSTEM STARTUP, INTERACTION AND OPERATION

The central database and support sub-systems; Help Desk, Expert system & Network support; are described in detail in the following sections. This section describes how these systems integrate on the hardware provided.

After the computer has been booted, (see SUN Systems Administration manual for details), the database system is initialised in the following way:-

- logon as the user 'oracle'
- enter 'password'
- enter the command 'sqldba'
- enter 'startup'
- enter 'exit'
- invoke a window system eg. enter 'sunview'
- in a window invoke the SQL*forms system by entering 'rtool'
- at the prompt enter username 'scott'
- at the prompt enter 'password'
- via SQL*forms interface select 'MAINMENU'

All interaction is now controlled by the SQL*forms application to access all systems required.

The user is given several menus from which to choose his/her next move. The user will always be automatically prompted for a particular response. Any invalid response will be greeted with an error message and the reasons why it is invalid.

Menu options can be selected via keyboard or mouse input. The mouse allows the user to select options in various ways such as 'pushing buttons' displayed on the screen; or clicking on options in pop-up menus; or simply pointing to a menu choice.

In addition to the automatic help given, additional on-line help is available at all stages in the system which will give guidance to the user concerning what data or its format to enter, or description of error messages that have occurred.

For a more detailed description of how to operate within the SQL*forms environment see APPENDIX G with reference to the 'SQL*forms Operators Guide'. This should be read in conjunction with Figures 5.1 and 5.2 'keypad layout for SUN'. As already mentioned, these keypad functions are also implemented via mouse driven menus.

The figures below show the SQL*Forms V2.3 function key layout on a Sun Workstation.

Below is the SQL*Forms V2.3 **runform** keypad layout on a Sun Workstation.

PRINT (F2)	RE-DISPLAY (F3)	DISPLAY ERROR (F4)	SHOW F-KEYS (F5)	HELP FIELD (F6)	LIST OF VALUES (F7)	(F8)	DELETE BACKWARD (F9

Delete Delete Char

EXECUTE QUERY (R1)	CREATE RECORD (R2)	COMMIT (R3)
CLEAR FIELD (R4)	CLEAR RECORD (R5)	CLEAR BLOCK (R5)
PREVIOUS FIELD (R7)	PREVIOUS RECORD (R8)	PREVIOUS BLOCK (R9)
MOVE CURSOR LEFT (R10)	ENTER QUERY (R11)	MOVE CURSOR RIGHT (R12)
NEXT FIELD (R13)	NEXT RECORD (R14)	NEXT BLOCK (R15)

FUNCTIONS	**KEY STROKES**
CHAR INSERT/REPLACE	ESC i
DUPLICATE FIELD	ESC 1
NEXT PRIM KEY FIELD	ESC TAB
DELETE RECORD	ESC d
DUPLICATE RECORD	ESC 2
NEXT SET OF RECORD	ESC s
BLOCK MENU	ESC b
EXIT/CANCEL	CTRL z
PRINT	ESC p
COUNT QUERY HITS	ESC 4
NEXT RECORD	CTRL n
PREVIOUS RECORD	CTRL p
NEXT FIELD	Return, Tab
CLEAR FORM/ROLLBACK	ESC c
MOVE CURSOR RIGHT	CTRL r
REDISPLAY	CTRL l

Function Key Layout on Sun Workstation for runform

Figure 5.1

Below is the SQL*Forms V2.3 **design** keypad layout on a Sun Workstation.

RE-DISPLAY (F3)	(F4)	SHOW F-KEYS (F5)	(F6)	(F7)	CUT (F8)	PASTE (F9)	DELETE BACKWARD Backsp.

Delete Delete Char

DEFINE (R1)	CREATE FIELD (R2)	COMMIT (R3)
CLEAR FIELD (R4)	UNDO (R5)	RESIZE FIELD (R5)
PREVIOUS FIELD (R7)	MOVE CURSOR UP (R8)	DRAW BOX/LINE (R9)
MOVE CURSOR LEFT (R10)	SELECT (R11)	MOVE CURSOR RIGHT (R12)
NEXT FIELD (R13)	MOVE CURSOR DOWN (R14)	SELECT BLOCK (R15)

FUNCTIONS	**KEY STROKES**
CHAR INSERT/REPLACE	ESC i
CUT	ESC d
EXIT/CANCEL	CTRL z
PASTE	ESC c
PRINT SCREEN	ESC p
RUN OPTIONS MENU	ESC b
MOVE CURSOR RIGHT	CTRL r
REDISPLAY	CTRL l
NEXT FIELD	Return, Tab

Function Key Layout on Sun Workstation for design

Figure 5.2

5.4.0 DATABASE IMPLEMENTATION

The following describes in detail the relational database tables used within the system. The format used will be the table type name followed by the attribute types used (field names) followed by a description of their use, range, type and format eg.

table_name(attr1, attr2, . . . attrn).

Any attributes with **serial** or **typebar** in their name combine to form a unique identifier for that entity / relationship and are underlined to indicate such. All BEM computer equipment supplied / installed have both these attributes printed on them and are guaranteed to be unique, thus allows for easy identification. In the eventuality that these markings do not already exist or a non-unique number is discovered during installation (old equipment or administration error) then this information will be recorded on the equipment in question, after modification of identifier if necessary.

Typical values are **123456/abcde df-123456677J**

Any attributes with **manuf** in their name refers to the manufacturer's name of that product.

Any attributes with **model** in their name refers to the model name of that product.

Any attributes with **alias** in their name refers to a more well known short hand version of manuf & model for easy identification by the layman.

The attribute **purch_ord** refers to the purchase order number generated by BEM to purchase the item concerned.

The standard format used is **MR1-08045**. However, to indicate other circumstances the following codes will be used for the purch_ord:

0000 = if item purchased, but purchase order number unknown

0001 = if item is on a lease agreement

0002 = if item is part of 'computer_base' purchase

0003 = if item is free of charge (loan, demo etc)

The attribute **div** refers to the division name within BEM that the item is located in. Typical values are, **RMD, TRC, ICD, WML,** etc.

The attribute **dept** refers to the department name the item is located in.

The attribute **location** is a descriptive reference to the items location.

COMPUTER_BASE (bserial, btypebar, bmanuf, bmodel, alias, hostid_num, hostid_nam, mouse, mathcopro, basemem, total_mem, cpu, ext_mem, ramrev, romrev, biosrev, mods, mctype, purch_ord, div, dept, location, kbd_serial, kbd_typebar, kbd_model, scr_serial, scr_typebar, scr_type, scr_manuf, scr_model, network)

Type: Entity

bserial & btypebar = of computer's base unit, (in the case of the DG computers the HOST names will be used for each of these 2 fields eg. HOSTG & HOSTG).

bmanuf = manufacturer of computer's base unit. Typical values are **SUN, ICL, DG,** etc. . .

bmodel = model of computer base unit. Typical values are **SPARC 4/65, M40, PCIV, MV15000/20** or simply a product code.

alias = alias of base unit model. Typical values are **SPARC 1+, SPARC SLC etc.**

hostid_num = unique combination of characters to identify the computer.

hostid_nam = the host name of the computer. Typical values are **HOSTG, NCPFS1 etc.**

mouse = indicates whether this computer has a mouse or not. Typical values are **Y, N.**

mathcopro = indicates whether this computer has a maths co-processor or not. Typical values are **Y, N.**

basemem = standard total main memory of computer. Typical values are **640K, 1MB etc.**

total_mem = total on-board main memory of computer system, including any expansions. Typical values are **640K, 1MB, 4MB etc.**

ext_mem = total extended configured memory. Typical values are **384K, etc.**

(total_mem - ext_mem = expanded memory.)

ramrev = revision level of main random access memory board.

romrev = revision level of main read-only memory board.

biosrev = bios revision level

mods = modifications. comments / details on any upgrades etc.

mctype = classification of computer. Typical values are, **PC-XT, PC-AT, WS** (for workstation), **MINI, MAINF** (for mini or main frame).

purch_ord = purchase order number for this item.

kbd_serial = serial number of this base unit's keyboard.

kbd_typebar = typebar of this base unit's keyboard.

scr_serial = serial number of this base unit's screen.

scr_typebar = typebar of this base unit's screen.

scr_type = indicates method of output of this computer.

The following values are used:

VGA
MULTISCAN
CGA
EGA
HARD (for teletype-writers)
HIRES
MONO
COLOUR

scr_manuf = manufacturer of screen if different from base unit

scr_model = model name of screen

network = indicates network capability.

The following values are used:

STANDALONE

DISKLESS

DATALESS

SERVER

STANDARD

cpu = name of main central processing unit. Typical values, for PC's **8086, 80286, 80386, 80486, 68000 etc. Workstations, 68040, SPARC RISC, etc.**

COMP_PORTS (serial, typebar, line, com, fld, interface, baud, databits, stopbits, parity, handshake, emulation)

Type: Entity

Underlined attributes uniquely identify the computer system and each of its serial ports, indicated by **line.**

Typical values of line are

CON2, CON3, . . . CONn (for DG AOS VS systems)

ttya, ttyb, ttyha . . . (for SUN UNIX systems)

COM1, COM2 . . . (for PC DOS systems).

com = a label used to identify computer ports & signal point connections

fld = as com

Typical values are FLD 1/022 etc

interface = indicates type of physical connection & signal

Typical values are **EIA, C.L, PARALLEL, etc**

baud = baud rate of communications line

Typical values, **4800, 7200, 9600 etc**

databits = number of bits for data

Typical values, **7, 8.**

stopbits = number of stop bits

Typical values **1,2**

parity = **even, odd, none, mark, space**

handshake = protocol used, typical values, **xon/xoff, DTR, BOTH, NONE, crtcts**

emulation = output emulation mode.

Typical values, **TVI925, D410, etc**

CONNECTION (hostserial, hosttypebar, line, dserial, dtypebar, swserial)

Type: Entity

Determines which computer port is connected to what peripheral device and whether it is via a data switch device or not.

hostserial, hosttypebar, line = identifies the computer system

dserial, dtypebar = identifies the peripheral device

swserial = identifies the data switch if one is used or has the following default value:

9999 = direct line from computer to device

COMP_COMP (serial, typebar, line, hostserial, hosttypebar, hline)

Type: Relationship

Identifies those computer communication lines / ports which are connected directly to another / same computer system communication line / port.

OUT_DEV (serial, typebar, type, manuf, model, papersize, ribbontype, media, interface_brd, feeder, language, mods, div, dept, location, purch_ord)

Type: Entity

serial, typebar = identifies an output device, (printer, plotter etc)

type = identifies type of output device. Typical values:

PRINTER, PLOTTER, PAPERTAPEPUNCH

papersize = identifies largest size of stationery used. Typical values:

A4, A3, A4DOUBLE

(when complete, the stock system product code could be used for this field).

ribbontype = identifies the media used for output. Typical values,
TONER (for laser printers), **RICHO1600** (ribbon make used by daisy wheels), **QUME5** (ribbon used by matrix printers), **HOLES** (punched holes for paper tape), **HPFIBRETIP** (for HP plotters).

(When complete, the stock system product code could be used for this field).

media = most commonly used stationery for this device, in this location. Typical values:
SINGLE-PART, GOODSIN-NOTES etc

(When complete, the stock system product code could be used for this field).

interface_brd = identifies any additional communications board attached. Typical values:

GRAM (for Epson printers)

feeder = identifies paper feed mechanism. Typical values:

CUT-SHEET, CONTINUOUS, BOTH, ROLL etc.

language = identifies language capability. Typical values:

POSTSCRIPT, STANDARD, etc.

mods = comment field, indicating any special modifications made.

PLOTTER_CONFIG (plserial, pltypebar, bypass, handshake, remote, eavesdrop, plotmode)

Type: Entity

For the specified plotter output device, identified by plserial & pltypebar, indicates the configuration details of this plotter.

bypass = **on / off**

handshake = **none / direct**

remote = **remote / local / standby**

eavesdrop = **eavesdrop / standalone**

plotmode = **standard / enhanced**

INP_DEV (serial, typebar, type, manuf, model, formsize, tapetype, div, dept, location, purch_ord)

Type: Entity

serial & typebar identifies the input device, such as a scanner, etc.

type = identifies type of output device. Typical values **SCANNER**

formsize = size of largest media for input. Typical values:

A4, A3, A4DOUBLE

tapetype = applies to paper tape readers. Typical values:

5 / 7 / 8

IO_DEV (serial, typebar, type, manuf, model, boardrev, boardemul, buffer, screenmode, mods, div, dept, location, purch_ord)

Type: Entity

serial & typebar identifies input/output device.

type = identifies type of device. Typical values:

VDU, XTERMinal, TELETYPE

boardrev = revision level of main processor / logic board within device.

buffer = size of internal memory / buffer. Typical values: **80K**

screenmode = colour or visual capabilities. Typical values:

AMBER, GREEN, MONO, COLOUR (for visual)

HARD (for hard copy devices, teletypes).

ANY_DEV (serial, typebar, type, manuf, model, boardrev, boardemul, buffer, screenmode, mods, div, dept, location, purch_ord)

Type: Entity

As for IO_DEV above but for any other type of device.

PERIPH_COMMS (pserial, ptypebar, status, interface, baud, databits, stopbits, parity, handshake, emulation, linedriver)

Type: Entity

Configuration details for the device identified by pserial & ptypebar.

status = indicates state of device. Typical values:

> **CONNECTED, DISCONNECTED, ALLOCATED, UNALLOCATED, TEMP, DERANGED etc.**

interface = **EIA, CL, PARALLEL, RS232 etc.**

baud = baud rate. 110, 300, 600, 1200, 2400, 4800, 7200, 9600, 19600. . .

databits = 7 / 8

stopbits = 1 / 2

parity = even / odd / none / mark / space / local

handshake = xon/xoff / none / dtr / both

emulation = DG / SUN

linedriver = indicates type of line driver used if one, eg. CL200

AUX_DEV (ioserial, iotypebar, oserial, otypebar)

Type: Relationship

Identifies those input/output devices, identified by ioserial & iotypebar, which have output devices directly attached via the serial auxiliary port, identified by oserial & otypebar.

DATA_SWITCH (swserial, interface, num_ports, mode_type)

Type: Entity

Details of a data switch device identified by swserial.

interface = **parallel** / **serial**

num_ports = number of ports

mode_type = **auto** / **manual** switching

MUX_DEV (serial, typebar, manuf, model, type, boardrev, comments, div, dept, location, purch_ord)

Type: Entity

Details of a multiplexer device, such as a port selector, identified by serial & typebar.

MUX_PORTS (serial, typebar, line, baud, databits, stopbits, status, interface, parity, handshake, emulation)

Type: Entity

Configuration details for each port identified by **line** of the multiplexer device identified by serial & typebar.

communications attributes same as PERIPH_COMMS

COMP_MUX (hostserial, hosttypebar, hline, mserial, mtypebar, mline)

Type: Relationship

Identifies those computer communication lines / ports, identified by hostserial, hosttypebar, hline, which are connected directly to a multiplexer port identified by mserial, mtypebar, mline.

mline typical values are: s0002000, s0002001 . . . (for Gandalf system)

MUX_DEVIO (mserial, mtypebar, mline, serial, typebar)

Type: Relationship

Identifies the multiplexer port and the associated input/output device connected to it.

PORT_PORT (mserial, mtypebar, mline, serial, typebar, line)

Type: Relationship

Identifies those multiplexer communication lines / ports, identified by mserial, mtypebar, mline, which are connected directly to another multiplexer port identified by serial, typebar, line.

DISKDRIVE (serial, typebar, manuf, model, int_ext, format_date, capacity, type, density, dsize, maint, purch_ord, tape, hostserial, hosttypebar)

Type: Entity

Diskdrive identified by serial & typebar.

int_ext = identifies whether the disk device is internal or external of the computer base unit. Typical values are:

I = internal
1 = external, first disk in the chain
2 = external, second disk in chain etc.

format_date = date the disk was formatted

capacity = total unformatted disk space capacity in **xMB** or **xKB**

type = **FIXED / REMOVABLE**

density = **SINGLE / DOUBLE / QUAD / HIGH / STD**

dsize = **3.5 / 5.25 / HARD**

maint = indicates whether this disk drive has its own maintenance contract or is part of the computer systems maintenance contract. Typical values:

BASEUNIT / OWN

tape = indicates whether disk drive unit has a built in tape drive. Typical values:

Y / N

hostserial & hosttypebar identify the computer system this is attached to.

TAPEDRIVE (serial, typebar, manuf, model, int_ext, capacity, tsize, maint, purch_ord, hostserial, hosttypebar)

Type: Entity

Tape drive identified by serial & typebar.

int_ext = identifies whether the tape device is internal or external of the computer base unit. Typical values are:

I = internal

1 = external, first tape drive in the chain

2 = external, second tape drive in chain etc.

capacity = maximum capacity of tape data. Typical values:

150MB / 60MB (.25" tape cartridge on SUN systems)

tsize = size of media. Typical values:

8mm (Exa-byte video) / **.5"** etc.

maint = as for DISKDRIVE.

TAPE_DISK (dskserial, dsktypebar, tapserial, taptypebar)

Type: Relationship

Identifies the tape drive built into the disk drive identified by dskserial & dsktypebar.

MOUSE (serial, typebar, manuf, model, type, buttons, purch_ord, hostserial, hosttypebar)

Type: Entity

type = **OPTICAL / BALL** etc

buttons = number of buttons on mouse

hostserial & hosttypebar identifies the base unit this mouse is connected to.

ASYNC_BRD (serial, typebar, manuf, model, start_line_num, num_ports, purch_ord, description, cross, hostserial, hosttypebar)

Type: Entity

Additional computer system serial ports are provided by connecting an asynchronous board identified by serial & typebar.

start_line_num = identifies the first port number. Typical values:

ttyh00 / ttyl00 (for UNIX systems) / **con2** (DG systems)

num_ports = identifies number of ports available.

description = general comments.

cross = indicates whether the serial TX and RX (2 & 3) connections have been crossed or not. Typical values:

Y / N (No, straight through connection, 2 to 2, 3 to 3)

hostserial & hosttypebar identify computer this is attached to.

CARDS (serial, typebar, manuf, model, bitsize, boardrev, type, purch_ord, description, memory, hostserial, hosttypebar)

Type: Entity

serial & typebar identify the internal computer boards or chips installed in the base unit of a computer identified by hostserial & hosttypebar.

bitsize = identifies size of internal bus connection or size of card. Typical values:

8 / 16 / 32 or **CHIP** for a chip or **SIMMS.**

boardrev = revision number of chip / board

type = indicates general function of card. Typical values:

NETWORK (for providing network connections etc)
MEMORY (for providing increased memory)
SCREEN (for screen buffer)
MATHCOPRO (for a maths coprocessor chip)
PERIPH (for providing external device drivers and connections)

memory = amount of memory provided if expansion memory chips or size of buffer for device attachments.

NW_NODE_CONNECT(ethernet_addr, internet_addr, protocol, interface_type, nis_type, nw_type, cardserial, cardtypebar)

Type: Entity

Identifies network communication configuration details for the card / device providing the network interface, identified by cardserial & cardtypebar.

ethernet_addr = unique address assigned by ISO for this particular network device. Typical format:

8:0:20:9:4c:ff

internet_addr = assigned during installation, uniquely identifies this network node point. Also determines the **class** of the network. Typical format:

192.9.200.2 (a class C network)
191.9.100.100 (a class B network)
127.9.150.5 (a class A network)

protocol = **TCP/IP, XNS, TOKEN**

interface_type = physical connection. Typical values:

BNC / RF / AUI

nis_type = network information service, a SUN n/w management product. Typical values:

SERVER / CLIENT / NONE

nw_type = **le0 / le0**

NW_COMPONENT (serial, typebar, manuf, model, revision, div, dept, location, purch_ord, type, description, segment_num, num_ports)

Type: Entity

Network component identified by serial & typebar.

revision = revision level.

type = **REPEATER / TAP / TXR** (transceiver) / **BRIDGE / POINT**

segment_num = LAN segment number of this point / connection to it.

num_ports = number of network ports available.

NODE_COMPONENT (serial.typebar, prev_serial.prev_typebar, length, cable_media, tap_num, cable_segnum, endpoint_code, nw_type, cable_type)

Type: Relationship

Identifies each network component in the order of connection, thus determining how the components are connected, distance between them etc.

serial & typebar identifies the current component.

prev_serial, prev_typebar identifies the previous component. (either a network card or a network component)

length = distance in meters from current component to previous component. eg. **10M**

cable_media = **OPTIC / THIN / THICK / 10BASE2 / 10BASE5 / 10BASET**

tap_num = if component is a network tap, specify number

cable_segnum = LAN segment number

endpoint_code = indicates whether the previous component was a card / network component. Typical values:

> **CARD** (prev_serial & prev_typebar identifies a CARD, connection to computer)
> **NW** (prev_serial & prev_typebar identifies a NWCOMPONENT)

nw_type = **ETHERNET / NBS / NOVEL**

cable_type = **BROADBAND / LAN**

SOFTWARE (licence_num, swname, revision, serial, product_num, manuf, description, status, swtype, purch_ord, apps_type)

Type: Entity

Software package identified by licence_num & swname, revision.

serial = serial number

product_num = product number of s/w

swname = trade name for s/w. Typical value:

dBASE IV, LOTUS 1-2-3

revision = revision number. Typical values:

3.1 (for LOTUS say)

description = other details, such as VIP number

status = **TEMP / PERM / ILLEGAL / LEGAL / NOTINSTALL**

swtype = **OS** (operating system, eg. DOS, UNIX etc) / **APPS** (application program) / **UTIL** (utilities)

apps_type = **WORDPROCESSOR / SPREADSHEET / DATABASE / etc.**

COMP_SW (licence_num, swname, revision, hostserial, hosttypebar)

Type: Relationship

Identifies which computer identified by hostserial & hosttypebar has what software.

LEASE_DETAILS (leaseid, contract, auth_num, supplier, fin_supplier, quart_charge, start_date, end_date, purch_ord)

Type: Entity

Lease agreements are identified by a lease agreement number, leaseid, and a contract number, contract.

auth_num = capital authority number

supplier = supplier of contract / goods

fin_supplier = supplier name of company providing the finance

quart_charge = quarterly charge

start_date = commencement date of lease agreement

end_date = completion date of lease

LEASE (leaseid, contract, serial, typebar)

Type: Relationship

Any equipment, identified by serial & typebar, that is on lease with the specified leaseid & contract.

MAINTENANCE (supplier, contract, start_date, end_date, warranty_end, prev_expiry, purch_ord, leaseid, contract)

Type: Entity

Maintenance contract for equipment maintenance covered by the supplier identified by supplier & contract.

start_date = start of maintenance cover

end_date = expiry date of maintenance

warranty_end = expiry date of manufacturers warranty if any.

prev_expiry = expiry date of previous maintenance contract

leaseid & contract identifies a lease agreement if maintenance is part of a lease agreement. If not, then these values are null.

DEV_MAINT (supplier, contract, serial, typebar)

Type: Relationship

Any item under maintenance identified by serial & typebar is associated with a maintenance company identified by supplier & contract.

INSTALLATION (serial, typebar, install, operative, reason, memo_job_num, status)

Type: Entity

When an item of equipment identified by serial & typebar, is installed / upgraded an entry is made.

install = date of installation / upgrade of this item

operative = person responsible for installation

reason = justification for installation

memo_job_num = reference number to memo / job sheet authorising / requesting installation

status = current state of installation. Typical values:

COMPLETE / CURRENT / NOSTART

FAULT_HISTORY (serial, typebar, reported, cleared, maint_supplier, fault_desc, wrk_done, div, dept, location)

Type: Entity

When an item is reported faulty, identified by serial & typebar an entry is made.

reported = date of fault first reported

cleared = date fault was corrected

maint_supplier = name of maintenance company who attended to fault

fault_desc = description of fault

wrk_done = description of corrective action performed

DEV_USERINFO (username, telephonext, div, dept, location, fserial, ftypebar)

Type: Ent-Rel

The person responsible for an item of equipment, identified by fserial & ftypebar, is identified by username & telephonext & div & dept & location.

INVOICE (supplier, invoice, inv_date, value_exvat, description, purch_ord, Authority_num, charges_num, date_cleared, comments)

Type: Entity

supplier = name of co. invoicing

invoice = invoice number

inv_date = invoice date

value_exvat = value of invoice not including VAT

Authority-num = BEM authority number

charges_num = BEM charges number

date_cleared = invoice passed date

description = goods/services supplied

See Appendix N for Listing of SQL Commands for Implementation of Database System.

See Appendix O for Partial Listing of SQL*Forms Program.

5.5.0 EXPERT SYSTEM

Again the Expert system is implemented using the SQL*forms interface which provides the necessary functionality and database interaction.

The help desk operative will receive a call concerning a faulty VDU say. The operative will select the SQL form, from the menu, corresponding to Expert System. A form will appear prompting for as many fields to be filled in as possible eg. The field ladled 'console status' will prompt the operative to enter the status of the faulty VDU. After as many fields can be filled in as is possible the operative will select 'go'. In response the expert system will display a message indicating the course of action to take to solve the fault. This is repeated until the fault is cleared or no more expert help is available. After which this sql*form is exited.

5.5.1 Demonstration of Expert System Logic

This section describes briefly the activities carried out when a VDU fault occurs. The help desk operative accesses the expert system. A form appears on the screen which prompts for as much information as is known to be entered. After which a set of instructions will appear. If as a result of the instructions the problem is cured the operative exits the expert system, else he/she will enter new, updated information into the form which once again will generate a response. For example. . .

USER RINGS: "my VDU keys do not work properly. . ."

HELP DESK: Routine indicated by flow chart in Figure 4.2 is followed to establish the details of the faulty VDU.

HELP DESK: Executes 'Expert help'.

HELP DESK: Selects form box corresponding to 'VDU keys not working'.

HELP DESK: Entry in form box to indicate make of VDU, say a 'VISA LINK 125' in this example.

HELP DESK: Selects GO.

EXPERT RESPONSE: "Ask user to enter VDU setup mode by pressing ^SETUP"

EXPERT RESPONSE: "Ask user to press the following keys: 'F' 'D' 'R' in that order"

EXPERT RESPONSE: "Ask user to exit setup mode by pressing the following keys: 'S' 'E'"

If this cures the problem then end, else if not then. . .

HELP DESK: Selects problem remains

EXPERT RESPONSE: "Ask user to switch off VDU, unplug signal leads, unplug power lead, unplug keyboard, replug all leads, switch on VDU".

If problem remains. . .

EXPERT RESPONSE: "Inform user that someone will attend to the fault in person"

The following logic rules were followed in dealing with this fault:

U5 && L6 = 'VISALINK125' ::= 5 + 6 + 7 set A5

U5 && (L6 <> 'VISALINK125' OR A5) ::= 15 set A15

U5 && A15 ::= 10.

5.5.2 Logical Operations / Rules

U4 && L6='TATUNG' && U1='04' ::= 3 + l1 + 4

U2 && L1 ::= 14

U2 && L2 ::= 1 set A1

U2 && L2 && A1 ::= 2 set A2

U2 && L2 && A2 && L6 = 'TATUNG' ::= 3 + 4 set A3

U2 && L2 && A2 && L6 <> 'TATUNG' ::= 11 + 13 + 14 set A11

U2 && L2 && (A11 OR A3) ::= 15 + 11 + 12 + 13 + 14 set A15

U2 && L2 && A15 ::= 10

U2 && L3 ::= 1 set A1

U2 && L3 && A1 ::= 2 set A2

U2 && L3 && A2 && L6 = 'TATUNG' ::= 3 + 4 set A3

U2 && L3 && (A3 OR L6 <> 'TATUNG') ::= 11 + 16 set A16

U2 && L3 && A16 ::= 15 + 13 + 14 set A15

U2 && L3 && A15 ::= 10

U2 && L7 ::= 1 set A1

U2 && L7 && A1 ::= 2 set A2

U2 && L7 && A2 && L6 = 'TATUNG' ::= 3 + 4 set A3

U2 && L7 && A2 && (L6 <> 'TATUNG' OR A3) ::= 8 set A8

U2 && L7 && A8 ::= 9 + 8 set A9

U2 && L7 && A9 ::= 15 set A15

U2 && L7 && A15 ::= 11 + 12 + 13 + 14 ::= TRUE

U2 && L4 ::= 1 set A1

U2 && L4 && A1 ::= 2 set A2

U2 && L4 && A2 && L6 = 'TATUNG' ::= 3 + 4 set A3

U2 && L4 && (L6 <> 'TATUNG' OR A3) ::= 8 set A8

U2 && L4 && A8 ::= 15 set A15

U2 && L4 && A15 ::= 10

U3 ::= 1 + 15 set A15

U3 && A15 ::= 10

U5 && L6 = 'VISALINK125' ::= 5 + 6 + 7 set A5

U5 && (L6 <> 'VISALINK125' OR A5) ::= 15 set A15

U5 && A15 ::= 10

Key:

&& = represents logical AND operation

x && y = where 'x' and 'y' have either or evaluate to TRUE or FALSE status

Ax = represents either TRUE or FALSE where 'x' represents an action operation code which was / was not performed previously.

::= = represents implies. The following actions are suggested

Set Ax sets the flag 'Ax' if operation code 'x' is executed. (see Ax above)

After each operation line is performed all flag's Ax are reset.

The boolean result of any of the above checks, eg. L1, can be determined by the Help Desk operative who will access the DG computer system and execute the command which will display that console's status eg. CONS @CONx. After which the 'form' displayed on the screen will prompt the operative to enter the status for each **check** field which is known eg. a field titled 'console disabled' would prompt the operative to enter 'Y' to indicate that it was disabled.

5.5.3 Master Key

The following are the checks, actions and logical operations required for VDU hardware faults:

operation code	**local checks**
L1	console disabled
L2	console enabled & logged off
L3	console enabled & logon/logoff in progress
L4	console enabled & logged on & clocking up CPU
L5	similar to L4
L6	VDU make
L7	console enabled & logged on & NOT clocking up CPU

operation code	**user checks**
U1	error messages
U2	screen blank / frozen / stuck
U3	no power
U4	similar to U2
U5	function keys / cursor keys not operating correctly
U6	reserved
U7	screen display faults SET U5

operation code	**actions**
1	^Q & check brightness control
2	^BREAK + ^Q
3	^, SHIFT, SETUP
4	^S + SETUP
5	^SETUP
6	F + D + R
7	S + E
8	Esc
9	^U + 9 + RETURN
10	Technical Support required
11	{DISABLE @CONx}
12	{TERMINATE @CONx}
13	{ASS @CONx} + {CLEAR/RXON @CONx} + {DEASS @CONx}
14	{ENAB @CONx}
15	"switch off VDU, unplug signal leads, unplug power lead, unplug keyboard, replug all leads, switch on VDU".
16	"press RETURN key 12+ times"

Key:

^x = represents depressing the CONTROL (CTRL) key and another key 'x' at once
x + y = represents depressing key 'x' and then pressing key 'y'
x, y = represents pressing key 'x' and key 'y' simultaneously
{abcde} = represents executing a command 'abcde'
"abcd" = represents a request / instruction to the user.

operation code	**Instruction / message**
I1	Follow procedure (specified in user guide) to enter, change, and exit the setup mode of the device.

5.6.0 HELP DESK

As already mentioned, the Help desk is implemented via the SQL*forms interface which manipulates the central database system as necessary. For example, any queries, updates or entering of new data concerning any of the following entities is now completely computer based:-

- Leasing details of all items;
- installation of hardware or software;
- fault information (details of a fault reported and its status);
- maintenance details for hardware or software;
- user details;
- All types of computer system and associated hardware and software;
- All networking data such as equipment type and location and performance information;
- Purchase details of all items;
- Configuration details of hardware and software;
- Communication configuration details (physical link information).

In addition to this computer implementation of help desk functions the list of recommendations indicated in Section 3.8.1 acts as guidelines to an efficient and successful help desk. These are summarised below:-

- Have phone manned at all times
- Provide a single point of contact for all computer system related enquiries
- Deal with initial calls within a fixed period (60 seconds say)
- Categorise nature of call
- Prioritise call
- Action call request:
  - . . . Field call if further help required
  - . . . Solve problems (via Expert system)
  - . . . Answer general questions
  - . . . Schedule Technical Support assistance
  - . . . Schedule on-site maintenance
  - . . . Progress and track faults previously reported
  - . . . Follow up on faults and solutions

- Inform users of problems (unexpected or scheduled)
- Be reliable
- Appear efficient
- Monitor performance of Maintenance firms
- Monitor performance of sections dealing with problems
- Analysis & highlighting of recurring problems

5.7.0 NETWORK SUPPORT

The Network support is a little more complicated than the other sub-systems since network performance statistics are required which SQL*forms is not capable of directly. Thus network information concerning networking components etc. are manipulated via SQL*forms but statistical information is generated via a call from SQL*forms to another application developed by the author using a 'tool-box' of utilities provided by a package called Sun Net Manager, (for a detailed description of this package's facilities see the Sun Net Manager users guide, Appendix G.20)

The sql*forms based system supports the following requirements:-

Allocation of the following node identification information when systems are installed ...

. . . Internet Address (Network number + Host id number)

. . . User id numbers

. . . User group names

. . . User group id numbers

. . . HOST names

. . . Network Information Services (SUN's NIS) Names

SunNet Manager support the following:-

A diagrammatic logical view of the location and interconnection of ...

. . . network nodes

. . . network components

. . . cabling

. . . network attachment points

. . . network cabling lengths

. . . cable / link media

. . . network traffic loads

. . . network performance between nodes and along segments

. . . Highlight performance problem areas in terms of segment and node loads.

Section 5.7.1 is the document which supports the following requirements:-

- Standardise on a company network class
- Server HOST names to be meaningful in terms of its location in the company
- Associate particular network identification groups to particular devices

A diagram of the BEM network system is shown in Figure 5.3. This represents the head-end of the company wide broadband network upon which will be many nodes connected. Network performance information is required about the various components on this network including the load on a LAN segment. A software toolkit is available from SUN Microsystems which allows the user of it to write routines which will monitor all packets on the network and produce various statistics. This package is called SunNet Manager, (SNM). The SunNet Manager brochure can be found in Figure 5.4

Using SNM the communication and computer systems in use can be graphically represented with corresponding technical information retrieved from the database. As an example of this Figure 5.23 shows a photograph of the BEM network system, as originally shown in Figure 5.3, produced by SNM.

5.7.1 Standards for Assigning Internet Addresses

Internet addresses are made up of 4 words, each of 8 bits. In the case of class 'B' networks (such as that in use here at the Brush site) the first two words are fixed (in the case of BEM to 191.9). The remaining two words are available for assigning to Internet Ports on the network, giving a maximum of 64516 ports on the network (addresses with either word set to either 255 or 0 are not to be used).

In order that the allocation of internet addresses can be made easy and maintainable the following guides have been used:-

1. Network devices fall into one of two categories:
   1.1 Single port devices (such as workstations, PC's and mainframe LAN controllers)
   1.2 Multiple port devices (such as ITC's on the Data General system, and terminal servers).

2. Ports associated with a device must be contiguous and not span across different groups (unless more than 254 ports are to be defined).

3. Internet addresses assigned to devices of the same type should be grouped together, wherever possible.

4. Internet addresses below x.x.100.0 and above x.x.254.254 are reserved (within this network) for special use.

5. Internet address 127.0.0.1 is reserved on all devices as a local "loop back" address.

6. Internet addresses with either word set to either 0 or 255 (i.e. x.x.0.0, x.x.255.0, etc. with the exception of 127.0.0.1 as in 5. above) are not to be used.

7. Internet addresses must only be issued by one authority on the network (for consistency this ought to be Technical Support, with agreement being sought from other companies on site if they are connected to the BEM network).

8. It is suggested that the network address 191.9.x.x be used for BEM network.

   It is essential that a record is kept of all allocated Internet Addresses in use, the machine name[1] associated with that address, its Ethernet address, and its location on site.

[1]It is essential that the machine names chosen are meaningful, i.e. the name should give an indication of the location of the computer or the department or area of interest which uses it, along with some sort of serial number within that area.

The following blocks of internet addresses have been defined, using the above guidelines:

191.9.100.001 to 191.9.109.254	SUN File Servers	2540 ports
191.9.110.001 to 191.9.119.254	Other File Servers	2540 ports
191.9.130.001 to 191.9.130.254	Main Frame and Data General ILC	254 ports
191.9.131.nnn to 191.9.150.nnn	first Data General ITC (nnn 001-12) 20^{th} Data General ITC	128 ports per ITC
191.9.151.001 to 191.9.159.254	PC's	2296 ports
191.9.160.001 to 191.9.199.254	Terminal Servers (1 port per physical port)	10240 ports
191.9.200.001 to 191.9.219.254	Workstations	5080 ports

The following internet addresses are currently in use:

Internet Address	Machine Name
191.9.100.001	NCPFS1
191.9.130.001	DGHOSTB
191.9.160.001	
to	SPIDER
191.9.160.010	
191.9.200.001	
191.9.200.002	
191.9.200.003	

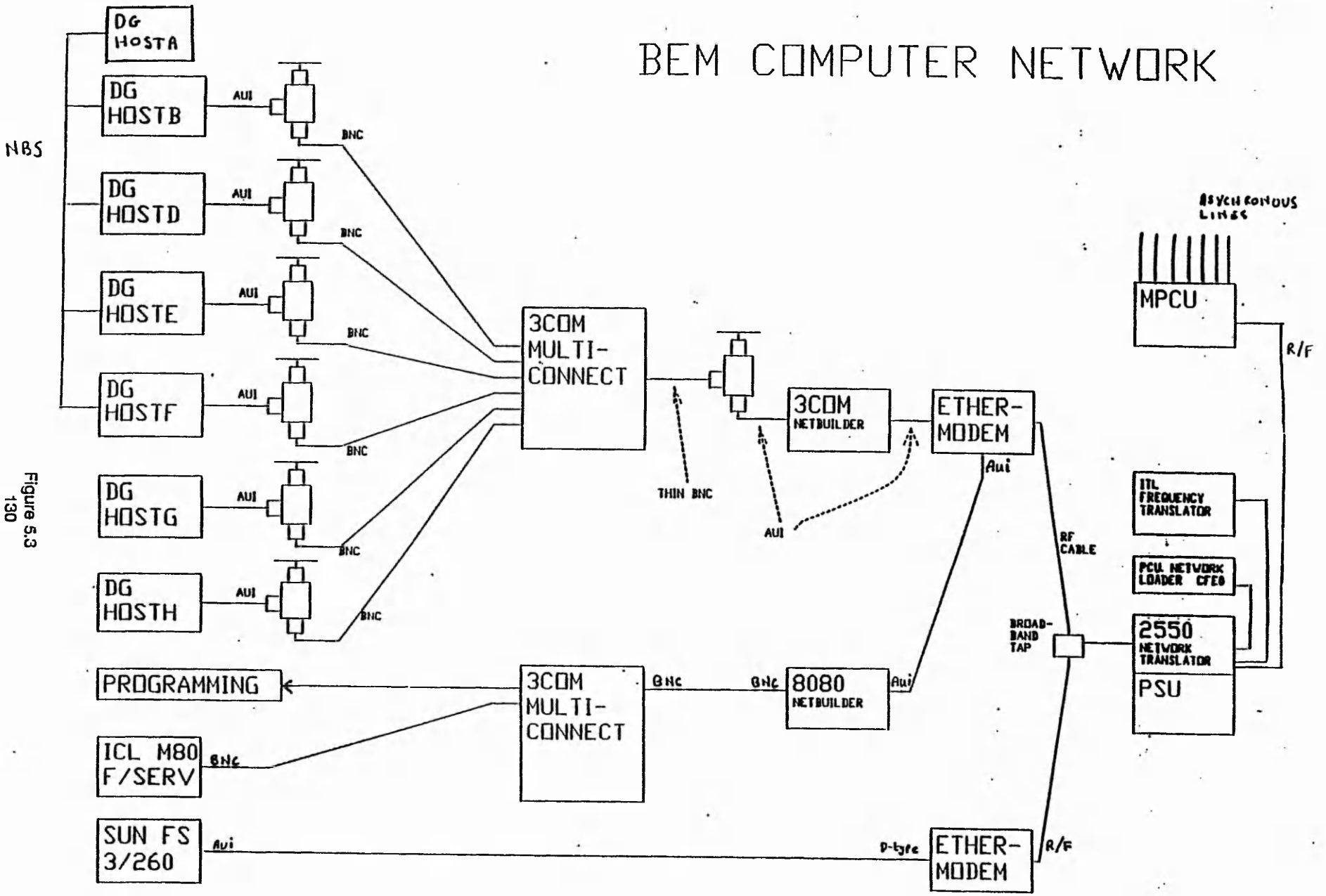
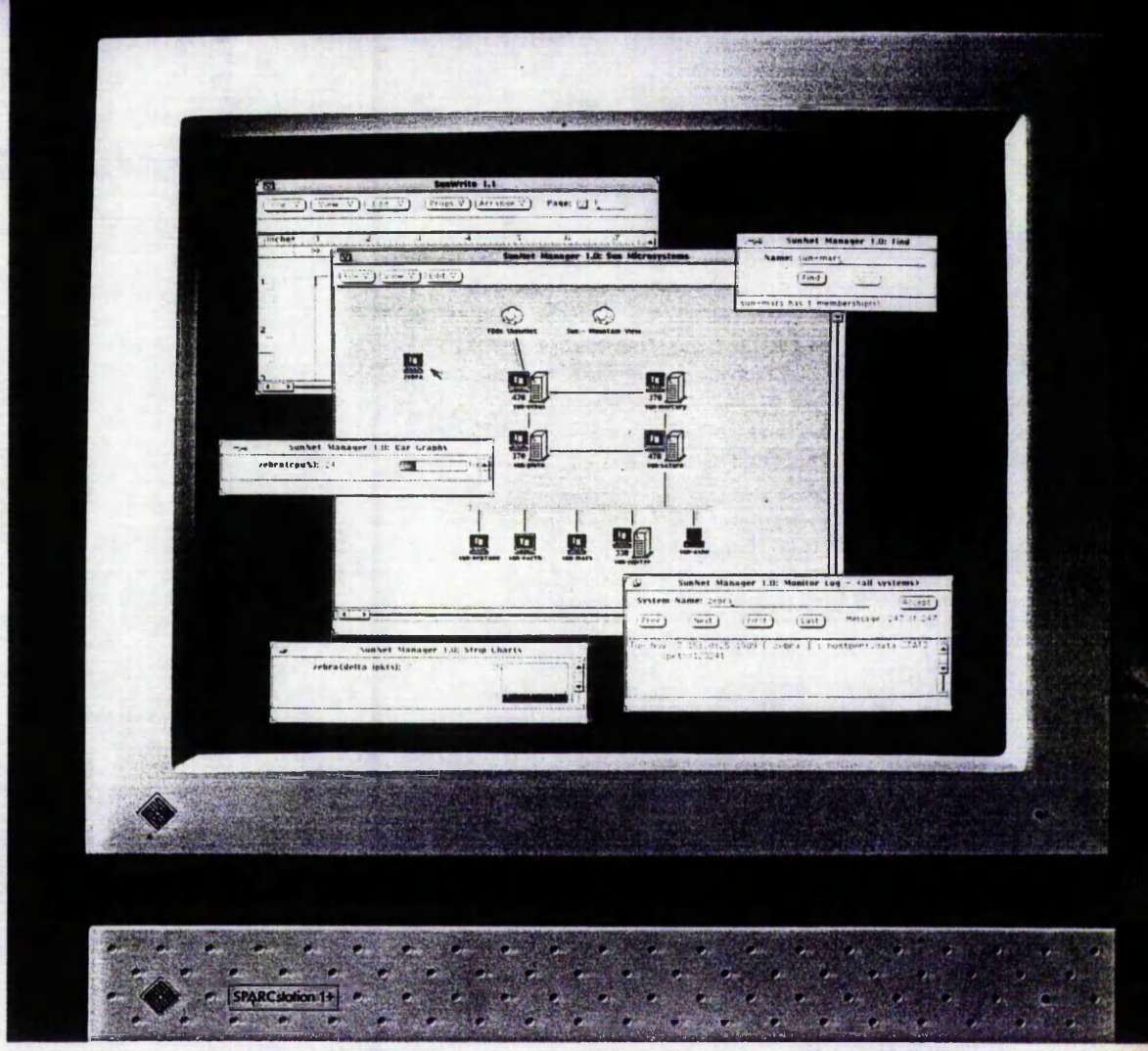


Figure 5.3
130



The SunNet Management Solution

Sun Microsystems, Inc., the pioneer of open computing, offers the broadest networking solutions in the industry, integrating innovative technology with the safety of industry standards. As networks grow in size and complexity, they become more cumbersome and expensive to manage. Organizations need a powerful, easy-to-use management system that changes with their needs. With the SunNet™ management solution, Sun provides the first open, extensible management platform available, simplifying network administration so managers and users have more time for other tasks. With SunNet Manager™ and SunNet License™—two members of the SunNet family—network management becomes an integrated part of the solution.

Like the other SunNet elements—connectivity, standards, and distributed access—SunNet management products deliver the balance of innovation and safety that makes the SunNet family of networking products the ideal solution for the open computing needs of today's distributed workgroups.

Figure 5.4

SunNet Manager Takes Care of the Network

SunNet Manager is a low-cost, easy-to-use network management platform that includes user and development tools for administrators of today's distributed workgroups. These powerful tools automatically monitor and analyze systems and networks, notify users only when they need to be involved, and free users to concentrate on their work instead of the system. Based on the International Standards Organization (ISO) Open Systems Interconnect (OSI) management framework, SunNet Manager lets system administrators transparently manage more heterogeneous resources in less time, so they can handle larger networks.

Network control is integrated through the OPEN LOOK™ Graphical User Interface (GUI). With the OPEN LOOK interface, all managed objects in the network can be represented graphically on the screen, with easily recognizable symbols—making it intuitive for users. SunNet Manager services and the OPEN LOOK GUI are available to users through documented programming interfaces with freely available specifications. New management tools can be integrated into SunNet Manager with the same look and feel. Devices and systems being designed for tomorrow's network management standards can be easily incorporated into SunNet Manager, either directly or through popular protocols such as the Simple Network Management Protocol (SNMP) or DECnet™ NICE.

SunNet Manager lets users customize their system by adding network devices, services, protocols, and more, as needs expand. Because it runs on SunOS™ and in the OpenWindows™ environment, SunNet Manager offers integrated access to a variety of network and system management programs from third-party vendors and users. Built on Sun's Open Network Computing (ONC™) environment, SunNet Manager can be installed in centralized or decentralized environments to suit organizational preferences.

SunNet Manager is beneficial for networks with more than ten nodes or networks with at least one gateway. It is extensible and standards-based to address large or small heterogeneous networks.

SunNet License Handles the Bookkeeping

Sun simplifies network resource management with SunNet License, a service supporting concurrent usage of software licenses. Under this model, a pool of licenses is available to users on the network, who can check out licenses as they need them. For example, if five license units for a certain software package are purchased for a 20-user network, up to five of the 20 users can concurrently work with the package at any time. SunNet License acts as a librarian, tracking the pool of licenses, limiting concurrent access to the licensed number of users. As a result, software vendors are not required to "lock" a package to a specific machine to ensure compliance with a license agreement. Instead, licenses can "float" across the entire network.

Users benefit both from the efficiency of concurrent licensing and the creative use of SunNet License. For example, developers can offer customers demonstration software with licenses that expire after a short period of time. The application choices can be fully tested at minimal expense of time and money, so users can make the best choice with the least amount of effort.

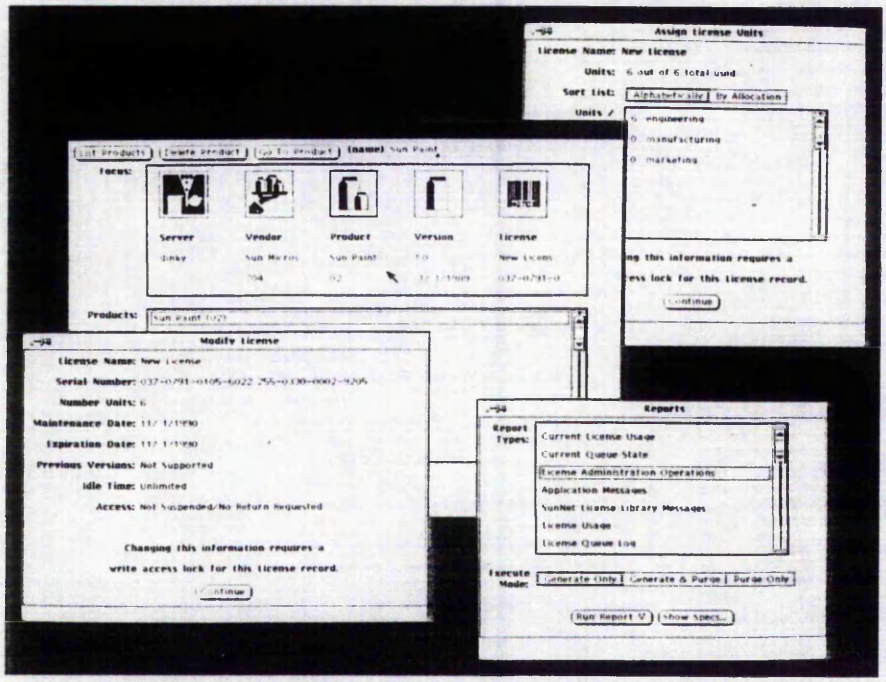
Exciting potential also exists for immediate product delivery to customers. The use of CD technology to distribute large numbers of applications at one time is becoming popular. Because SunNet License allows users to create programs with built-in protection, they pay for only the software they want. Software vendors benefit from reduced manufacturing, inventory, and distribution costs.

For both users and system administrators, SunNet License eases administration by offering the License Administration Tool, which is based on the OPEN LOOK interface. Additionally, SunNet License is specifically designed and marketed to satisfy the requirement of a single software administration point. Software developers include SunNet License client libraries with their applications, and vendors bundle SunNet License with their products to satisfy this administration requirement.

SunNet License is another example of the powerful ONC environment. A distributed application based on Remote Procedure Call (RPC)—an ONC service—SunNet License shares the benefits of portability that the Network File System (NFS®) has used most effectively. SunNet License source code is licensed to the industry to ensure widespread availability of the technology on multiple platforms. On other platforms, where it is given the more generic name of Net License, it provides a standard heterogeneous concurrent-licensing product with easy single-point administration.

The Open Solution Is the Only Solution

SunNet network management solutions provide a common set of tools—plus extensibility to create new tools—for monitoring and controlling any network-based resource. Organizations save time and money, because people on the network can concentrate on their jobs—and let the network manage itself. And since the best systems are those that not only observe emerging standards, but also make it easy to integrate existing and complementary applications, SunNet management products provide the best solution for managing today's distributed workgroup needs.



The License Administration Tool hierarchically organizes license servers across the network to increase the productivity of network software administrators.

5.8.0 IMPLEMENTATION OF STANDARDS

Standardising on configurations has many benefits as already discussed. Therefore, to achieve this standardisation configuration details must be specified as a guideline to follow. See Figure 5.5 for specification of a 'standard directory structure for a standalone PC'.

DIRECTORY STRUCTURE FOR STANDARD P.C. SETUP:

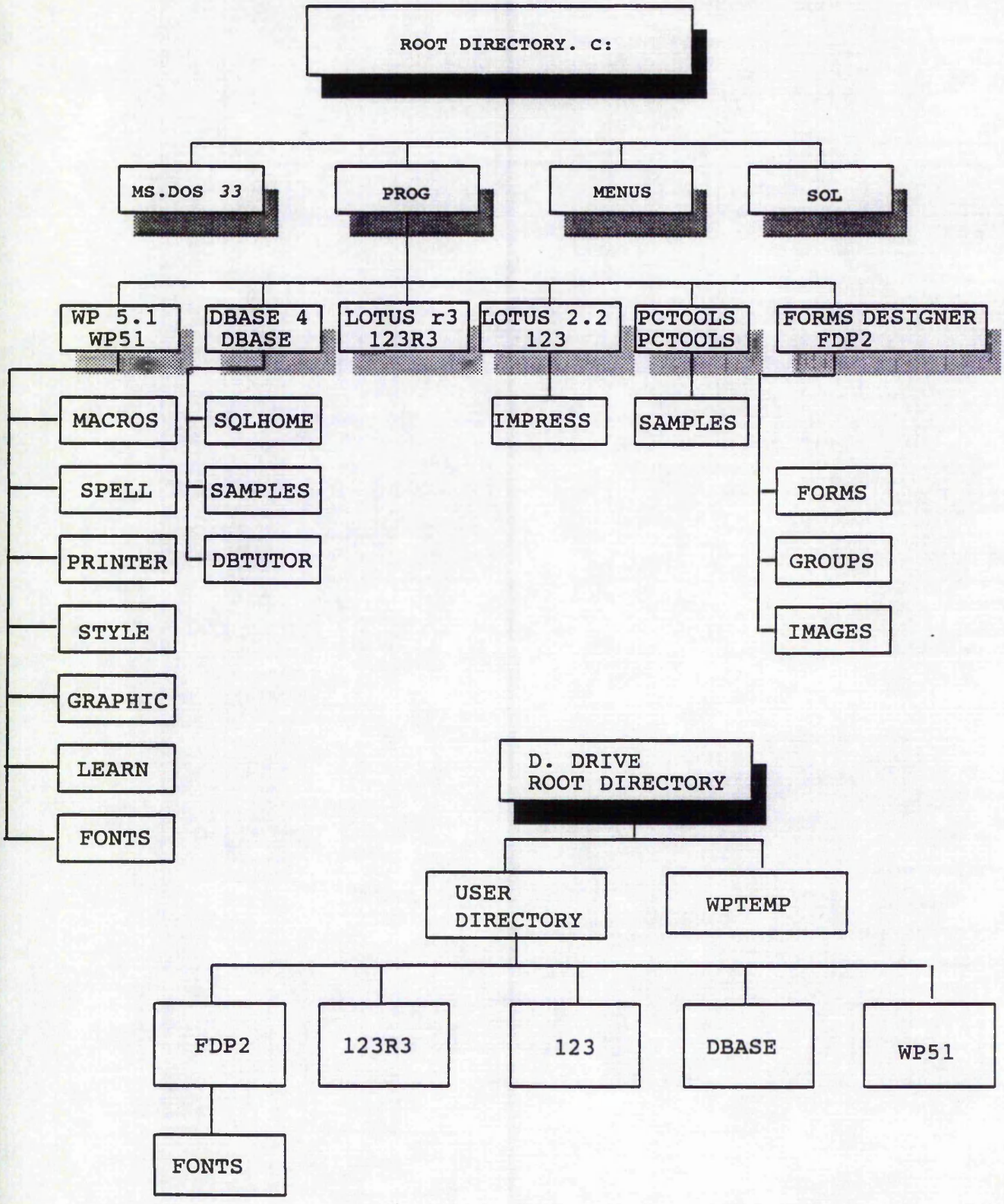


Figure 5.5

5.9.0 THE WAY TO OPEN SYSTEMS

The expansion of the Computer Department's facilities has been documented in Figures 5.6. To achieve open systems the following standards have been adopted. The importance of standards is discussed in Chapter 6, but these figures serve to show us how computer systems are evolving and the importance to document the past, current and future configurations in this way, thus allowing comparisons to be made and help avoid making repeat mistakes.

BRUSH ELECTRICAL MACHINES LIMITED

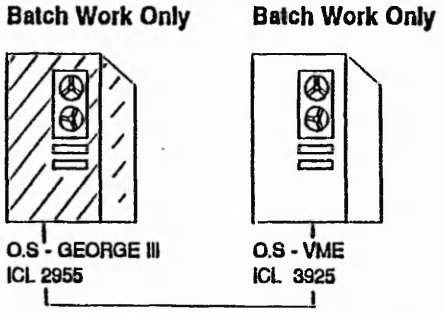
THE WAY TO OPEN SYSTEMS

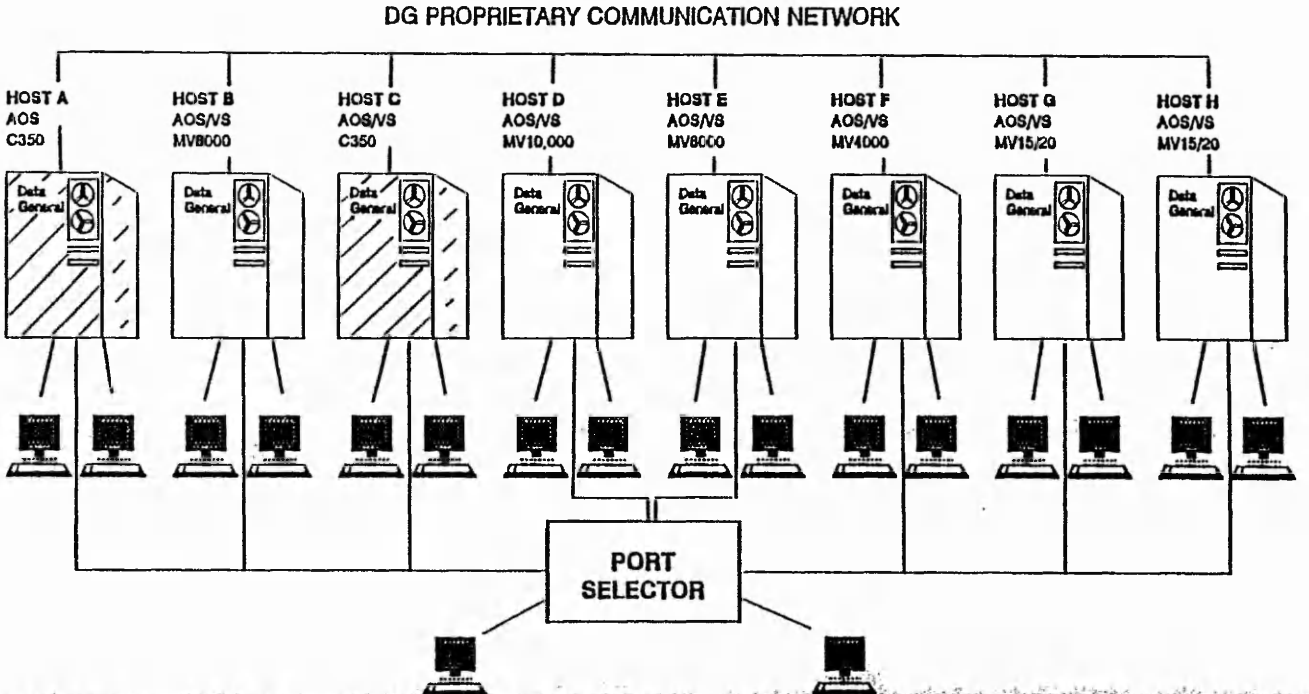
- **ORACLE 4TH GENERATION ENVIRONMENT**
- **RELATIONAL DATABASE MANAGEMENT SYSTEM**
- **DISTRIBUTED COMPUTING**
- **CLIENT/SERVER ARCHITECTURE**
- **BUSINESS SYSTEMS STRATEGY**
- **SOFTWARE**
  - ORACLE - RDBMS
  - WORDPERFECT - WORDPROCESSING
  - LOTUS 1-2-3 - SPREADSHEETS
  - DBASE IV - PC USER WRITTEN APPLICATIONS
- **COMMUNICATIONS**
  - ITL BROADBAND
  - 3 COM 3 + OPEN LOCAL AREA NETWORK
  - LAN MANAGER
  - TCP/IP
  - LAN MANAGER - UNIX
- **HARDWARE**
  - MID-RANGE/MINI-COMPUTERS
  - PERSONAL COMPUTERS - 286/386 ICL
  - WORKSTATIONS - SUN
- **OPERATING SYSTEMS**
  - MSDOS
  - OS 2
  - UNIX

Figure 5.6

ORIGINAL HARDWARE CONFIGURATION

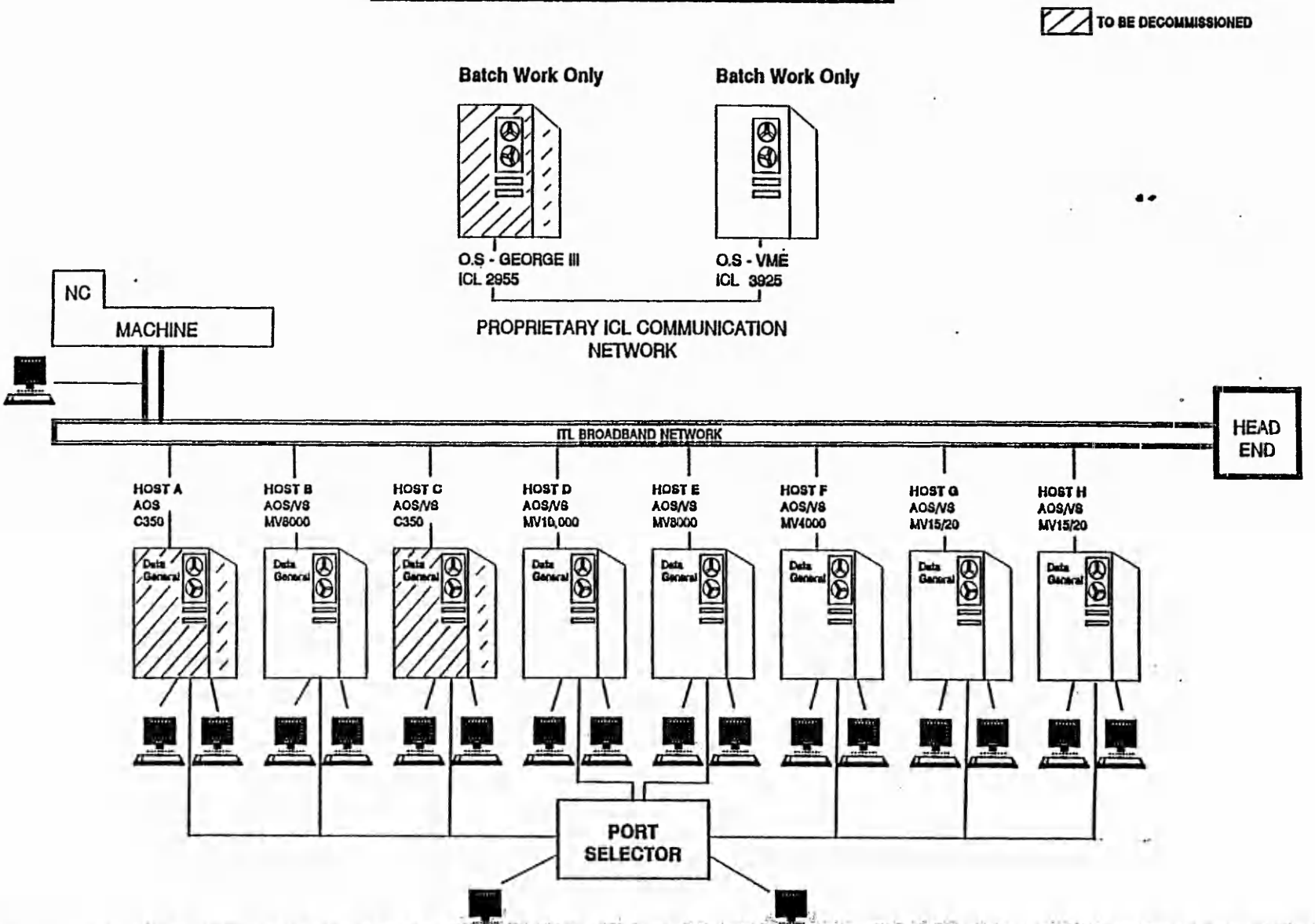
TO BE DECOMMISSIONED





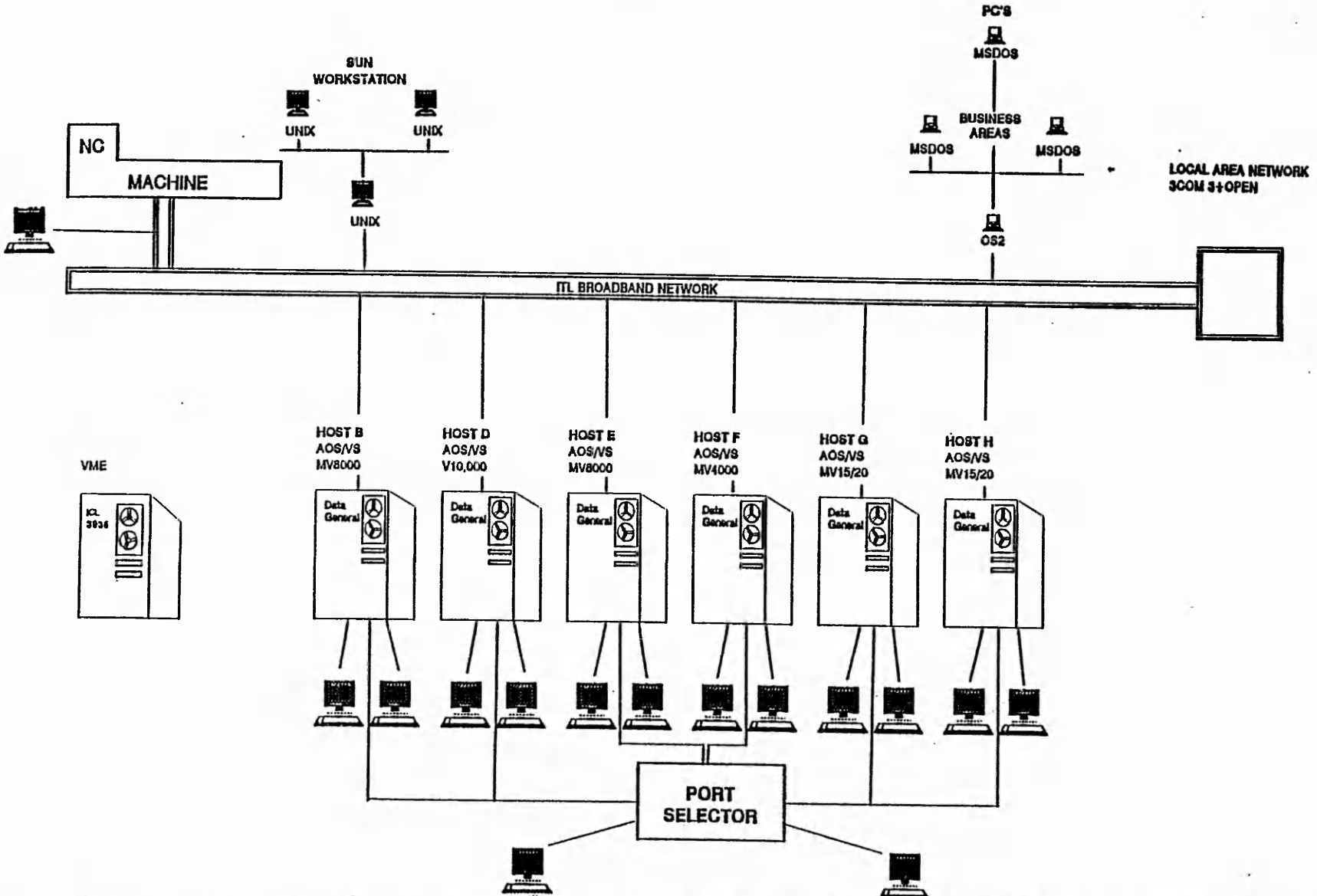
THE WAY TO OPEN SYSTEMS

Step 1 — 1989 Establish Initial Broadband Network



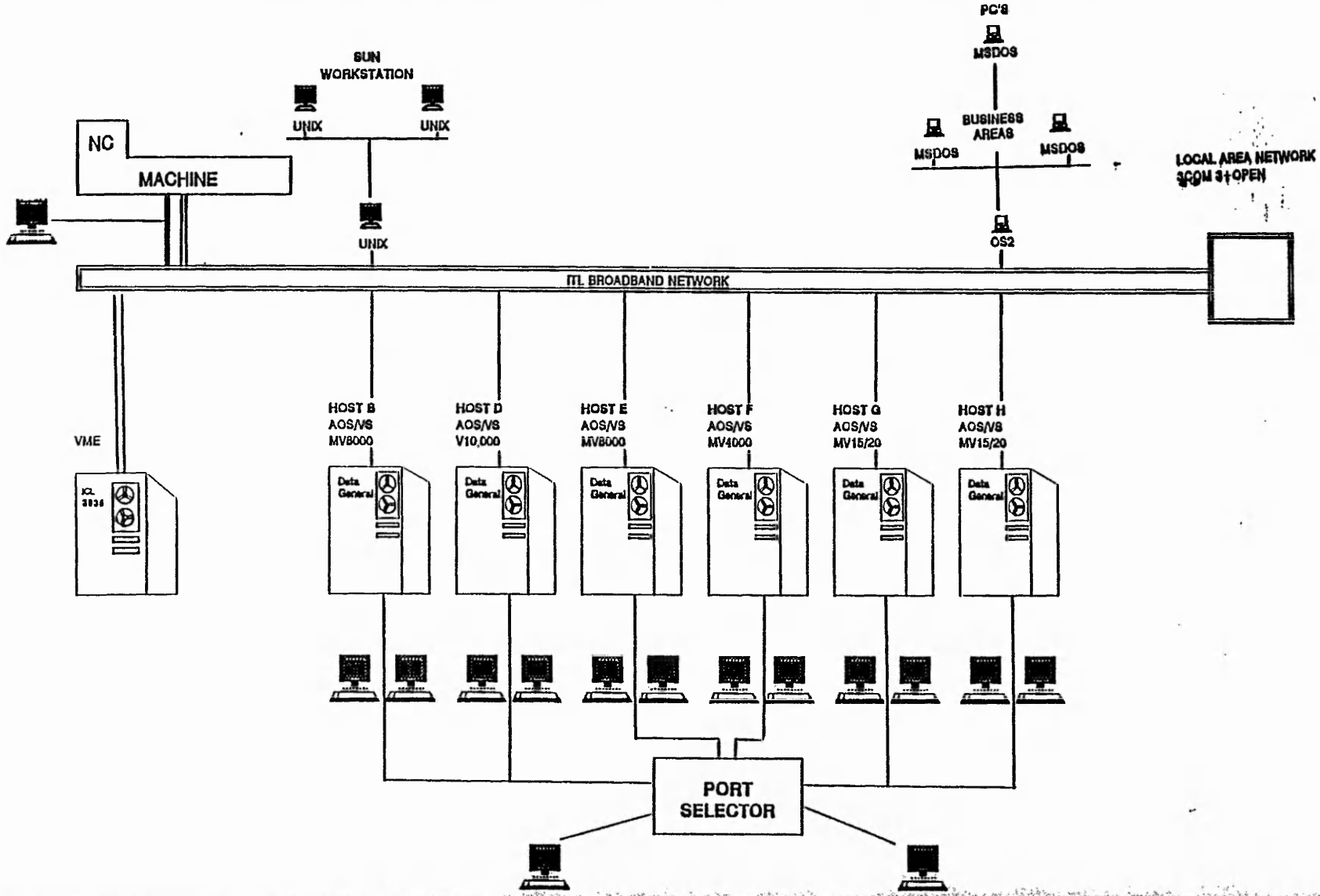
THE WAY TO OPEN SYSTEMS

Step 2 - 1990 Establish PC and Workstation Network



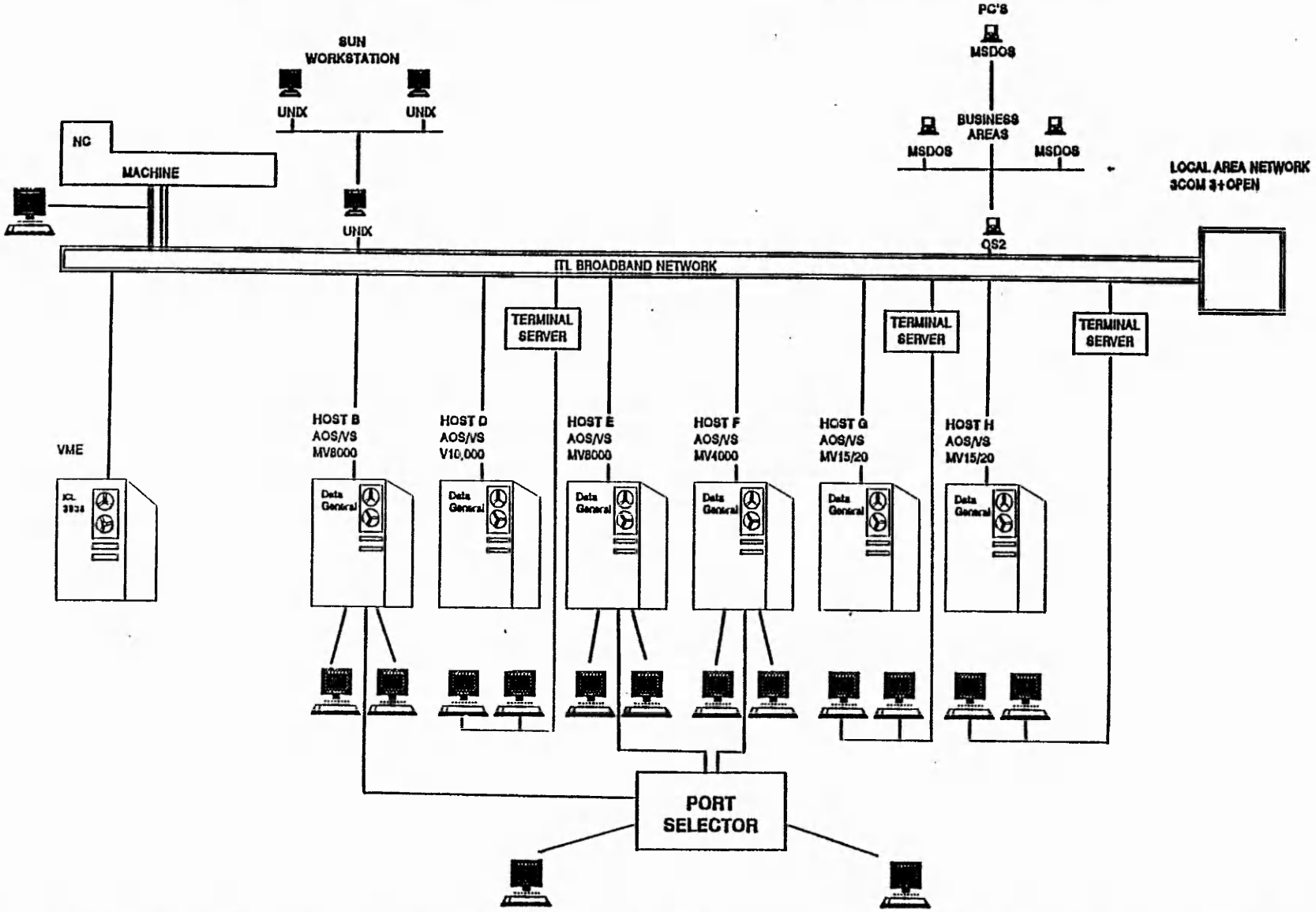
THE WAY TO OPEN SYSTEMS

Step 3 - DEC 1990 Include ICL In the Network and add more PC's for Online Work



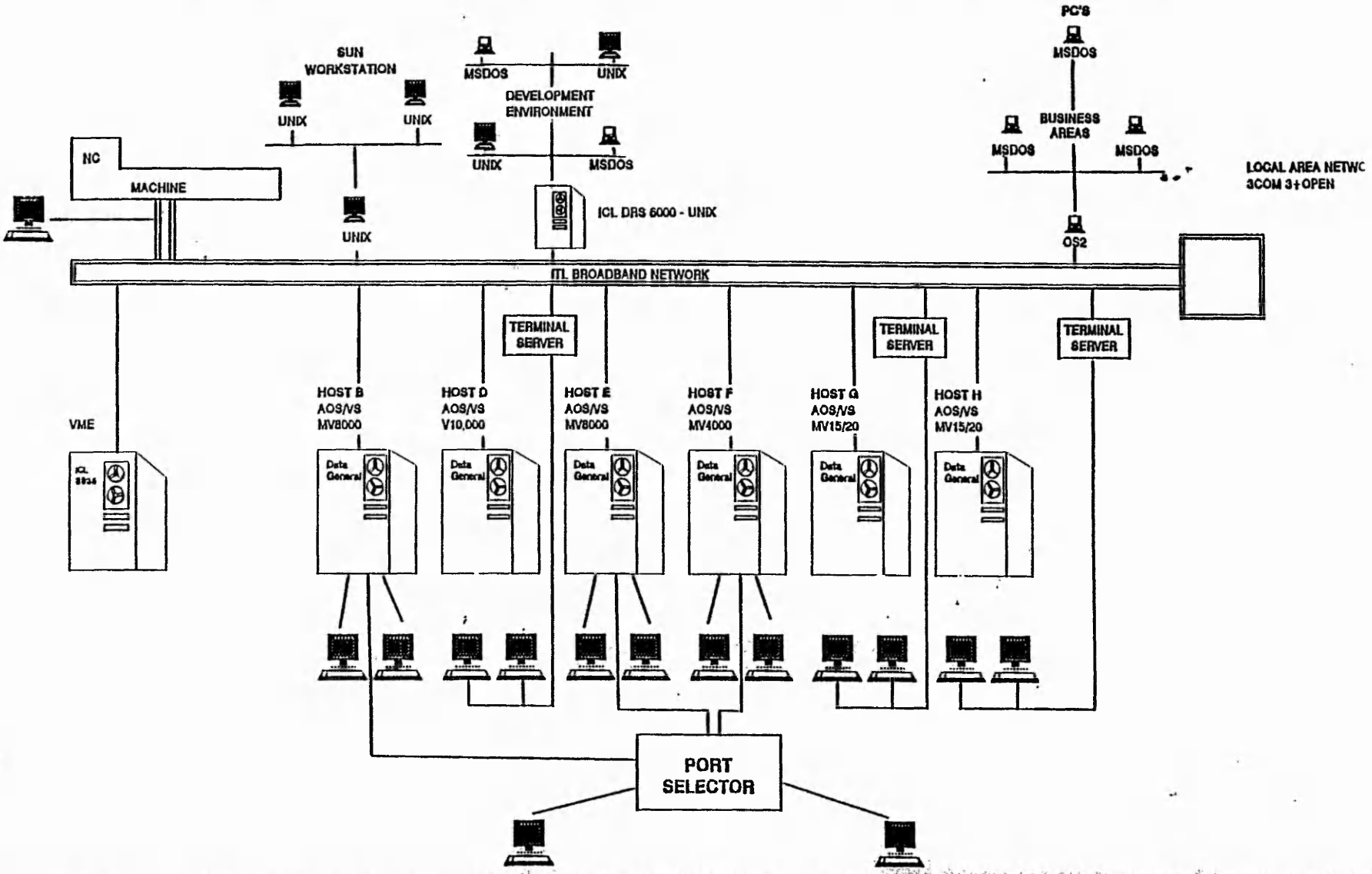
THE WAY TO OPEN SYSTEMS

Step 4 - 1990/1991 Connect Terminals to Broadband to gain access to any Computer



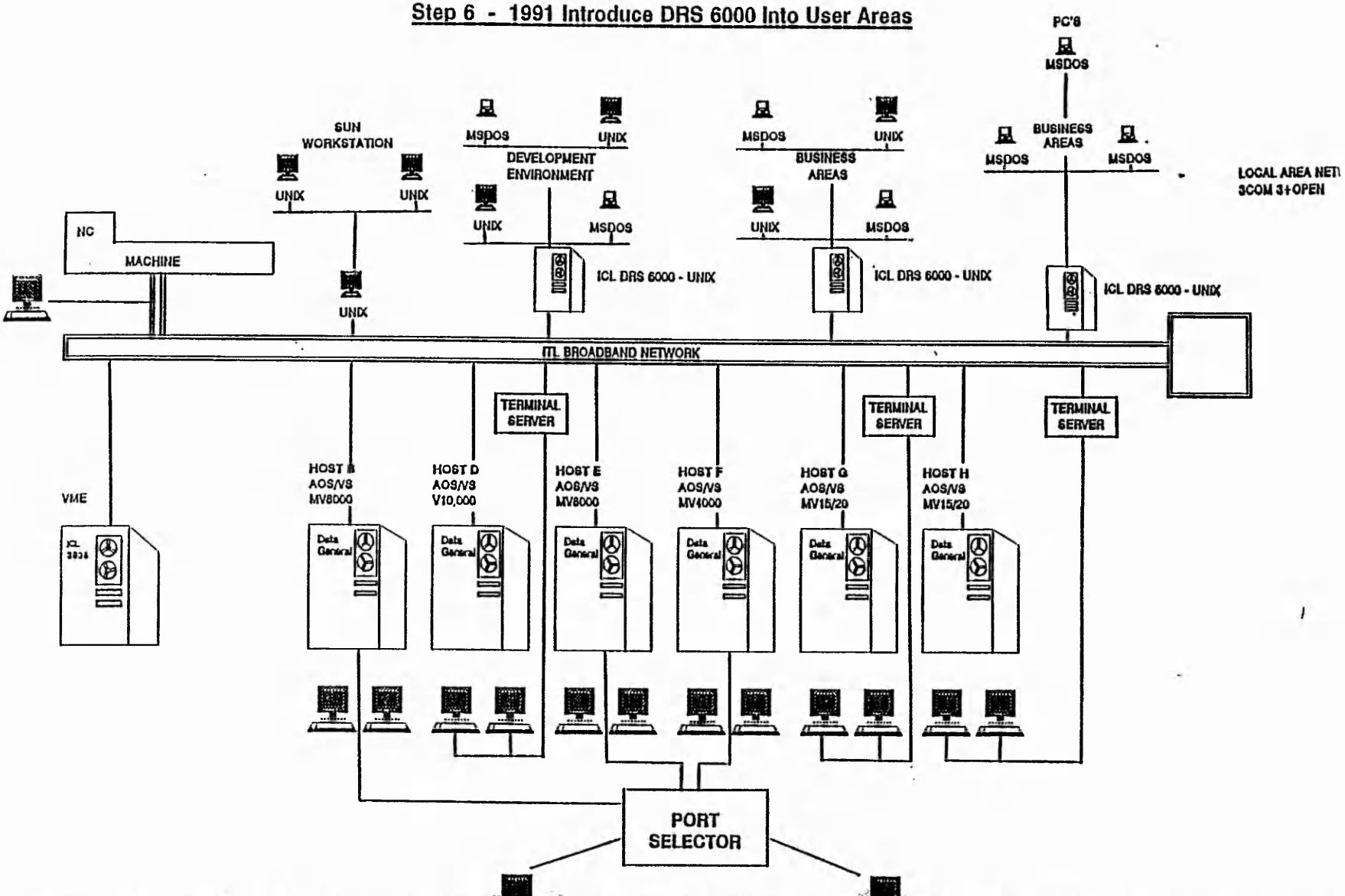
THE WAY TO OPEN SYSTEMS

Step 5 - 1991 Set up Computer Services Development and Test Environment with a DRS 6000 UNIX Server



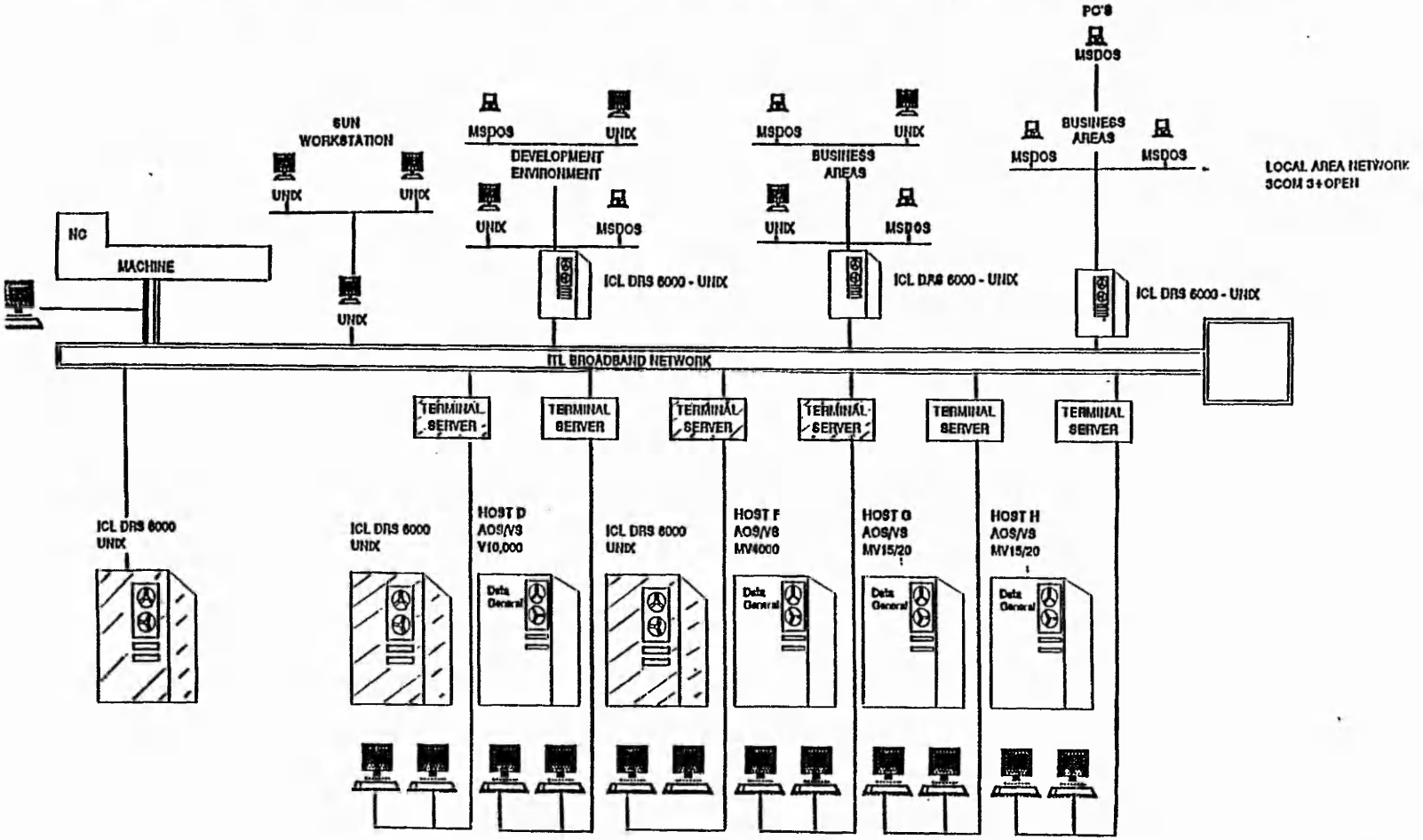
THE WAY TO OPEN SYSTEMS

Step 6 - 1991 Introduce DRS 6000 Into User Areas



THE WAY TO OPEN SYSTEMS

Step 7 - 1991 Onwards Gradually replace ICL and Data General Proprietary ...achines with ICL DRS 6000 UNIX Servers



The following Figures 5.7 and 5.8 are the Front Sheets to the ISO 9000 series of recommendations for Help Desk type systems from which much useful information was obtained.

ICL

MANUFACTURING &
COMMERCIAL

ICL (UK) LIMITED
COMPUTER HOUSE
127 HAGLEY ROAD
EDGBASTON
BIRMINGHAM B16 8LD
TELEPHONE 021 456 1111
TELEX 22971

Ian,

The enclosed document is, I think, what you are after. This item is confidential in that it is CONTROLLED and is not supposed to be copied.

You can purchase a copy of BS 5750 from HM Stationers Offices or B.S.I direct (Cost approx £22).

On no account must it be distributed.
(I shall deny Everything).
Please destroy, when you have finished with it.

Regards, [redacted].

P.S. Please phone me if you have any queries.

Figure 5.7

```
Current Library MCBU, Set 1, Record 7 of 11                    Line 1

BS5750: PART 1:1987 /ISO9001-1987. QUALITY SYSTEMS. Specification for
Design/development, production, installation and servicing.

Document Number      DN= BS5750 PART 1 1987
Publication Date     PD= 18/12/89
Author               AU= Quality Manager M&C BU
Published by           : Quality Manager M&C BU
Text                 TX=
IMPORTANT NOTE.

BS5750 PART 1 1987.

This document is held on TEXT database with the written agreement
of BSI and for which a licence fee has been made. It is for
reference only. Should a permanent copy of the standard be
required then these can be purchased from BSI, Sales Department
at Milton Keynes.

The written agreement is between Mrs P Danvers, BSI Marketing and

USE: B,F,L,H,S,G,+,                HELP: ?,B,C,?command,?lib   (SEND) to continu
```

Figure 5.8

5.10.0 SAMPLE OUTPUT FROM HELP DESK DATABASE

On request for data communication protocol and link configuration information for a Packet Communication Unit (PCU) say, see Figure 5.3 (MPCU sub-unit), an enquiry for this type of device was executed. An SQL*Form emulates closely the format of the data displayed by the PCU itself as the contents of this wallet indicate. This helps to find the required information quicker.

To be able to produce this information easily is a great benefit to technical staff when they, at short notice (in the case of a fault), need to cross-check the correctness of the setup during the course of their investigation.

apple Terminal line to SUN.

```
     SYTEK 2540 (M)  9601 5453 90  V2.3.3     FF2F7A  5  1000,FF,03  6

UNIT            2F7A,1          BAUD            9600        IDLE            5
CHANL RANGE     *               PARITY          EVEN        EOM COUNT       0
CHANSP          *               DATA            7           EOM CHARACTER   NONE
LAP ADDRESS     0               STOPS           1           NEWLINE         0D
CURRENT CHANL   6               AUTOBAUD        OFF         EXPAND          NONE
HOME CHANL      *               DCD CONTROL     OFF         XON             11,11
COMMAND         NONE            DSR CONTROL     OFF         XOFF            13,13
LISTEN          ON              DTR CONTROL     OFF         FLOW            XON,XON
PRIVILEGE       ON              DMODE           F,P         TIMEOUT         0
MAXSESSION      1               ECHO            OFF         EMULATE         NONE
PCALL           AUTO            QUIET           ON
PENTRY          SUNB            PASSWORD        OFF
```

apple Terminal line to VISA LINK 125 Terminal.

```
     SYTEK 2540  5401 5453 90  V2.3.3     FF1CE0  0  1000,FF,03  6

UNIT            1CE0,1          BAUD            9600        IDLE            5
CHANL RANGE     6-25            PARITY          NONE        EOM COUNT       0
CHANSP          300             DATA            8           EOM CHARACTER   NONE
LAP ADDRESS     0               STOPS           1           NEWLINE         0D
CURRENT CHANL   6               AUTOBAUD        OFF         EXPAND          NONE
HOME CHANL      6               DCD CONTROL     OFF         XON             11,11
COMMAND         2B,2D           DSR CONTROL     OFF         XOFF            13,13
LISTEN          ON              DTR CONTROL     OFF         FLOW            XON,XON
PRIVILEGE       ON              DMODE           F,P         TIMEOUT         0
MAXSESSION      1               ECHO            OFF         EMULATE         NONE
PCALL           OFF             QUIET           OFF
PENTRY                          PASSWORD        OFF
```

apple CNC line to SUN.

```
     SYTEK 2540 (M)  9601 5453 90  V2.3.3     FF2F7A  5  1000,FF,03  6

UNIT            2F7A,0          BAUD            9600        IDLE            5
CHANL RANGE     *               PARITY          EVEN        EOM COUNT       0
CHANSP          *               DATA            7           EOM CHARACTER   NONE
LAP ADDRESS     0               STOPS           1           NEWLINE         0D
CURRENT CHANL   6               AUTOBAUD        OFF         EXPAND          NONE
HOME CHANL      *               DCD CONTROL     OFF         XON             11,11
COMMAND         1B,7F           DSR CONTROL     OFF         XOFF            13,13
LISTEN          ON              DTR CONTROL     OFF         FLOW            XON,XON
PRIVILEGE       ON              DMODE           F,P         TIMEOUT         0
MAXSESSION      1               ECHO            OFF         EMULATE         NONE
PCALL           AUTO            QUIET           ON
PENTRY          SUN             PASSWORD        OFF
```

apple CNC line to CNC.

```
     SYTEK 2540  5401 5453 90  V2.3.3     FF1CE0  0  1000,FF,03  6

UNIT            1CE0,0          BAUD            4800        IDLE            5
CHANL RANGE     6-25            PARITY          EVEN        EOM COUNT       0
CHANSP          300             DATA            7           EOM CHARACTER   NONE
LAP ADDRESS     0               STOPS           1           NEWLINE         0D
CURRENT CHANL   6               AUTOBAUD        OFF         EXPAND          NONE
HOME CHANL      6               DCD CONTROL     OFF         XON             11,11
COMMAND         1B,7F           DSR CONTROL     OFF         XOFF            13,13
LISTEN          ON              DTR CONTROL     OFF         FLOW            XON,XON
PRIVILEGE       ON              DMODE           A,P         TIMEOUT         0
MAXSESSION      1               ECHO            OFF         EMULATE         NONE
PCALL           OFF             QUIET           ON
PENTRY                          PASSWORD        OFF
```

v510 Terminal line to SUN.
SYTEK 2540 (M) 6801 5453 90 V2.3.3 00C9E4 3 1000,FF,03 6

UNIT	C9E4,1	BAUD	9600	IDLE	5
CHANL RANGE	*	PARITY	NONE	EOM COUNT	0
CHANSP	*	DATA	8	EOM CHARACTER	NONE
LAP ADDRESS	0	STOPS	1	NEWLINE	0A
CURRENT CHANL	6	AUTOBAUD	OFF	EXPAND	NONE
HOME CHANL	*	DCD CONTROL	OFF	XON	11,11
COMMAND	1B,7F	DSR CONTROL	OFF	XOFF	13,13
LISTEN	ON	DTR CONTROL	OFF	FLOW	NONE,XO
PRIVILEGE	ON	DMODE	F,P	TIMEOUT	0
MAXSESSION	1	ECHO	OFF	EMULATE	NONE
PCALL	AUTO	QUIET	ON		
PENTRY	WADVDU	PASSWORD	OFF		

v510 Terminal line to VISA LINK 125 Terminal.
SYTEK 2540 5000 5453 90 V2.3.3 008C56 0 1000,FF,03 6

UNIT	C770,1	BAUD	9600	IDLE	5
CHANL RANGE	6-25	PARITY	NONE	EOM COUNT	0
CHANSP	300	DATA	8	EOM CHARACTER	NONE
LAP ADDRESS	0	STOPS	1	NEWLINE	0D
CURRENT CHANL	6	AUTOBAUD	OFF	EXPAND	NONE
HOME CHANL	6	DCD CONTROL	OFF	XON	11,11
COMMAND	1B,7F	DSR CONTROL	OFF	XOFF	13,13
LISTEN	ON	DTR CONTROL	OFF	FLOW	XON,XON
PRIVILEGE	ON	DMODE	F,P	TIMEOUT	0
MAXSESSION	1	ECHO	OFF	EMULATE	NONE
PCALL	OFF	QUIET	ON		
PENTRY		PASSWORD	OFF		

v510 line to SUN
SYTEK 2540 (M) 6801 5453 90 V2.3.3 00C9E4 3 1000,FF,03 6

UNIT	C9E4,0	BAUD	9600	IDLE	5
CHANL RANGE	*	PARITY	EVEN	EOM COUNT	0
CHANSP	*	DATA	7	EOM CHARACTER	NONE
LAP ADDRESS	0	STOPS	1	NEWLINE	0D
CURRENT CHANL	6	AUTOBAUD	OFF	EXPAND	NONE
HOME CHANL	*	DCD CONTROL	OFF	XON	11,11
COMMAND	1B,7F	DSR CONTROL	OFF	XOFF	13,13
LISTEN	ON	DTR CONTROL	OFF	FLOW	XON,XON
PRIVILEGE	ON	DMODE	F,P	TIMEOUT	0
MAXSESSION	1	ECHO	OFF	EMULATE	NONE
PCALL	AUTO	QUIET	ON		
PENTRY	WADKN	PASSWORD	OFF		

v510 line to CNC
SYTEK 2540 5000 5453 90 V2.3.3 008C56 0 1000,FF,03 6

UNIT	C77D,0	BAUD	4800	IDLE	5
CHANL RANGE	6-25	PARITY	EVEN	EOM COUNT	0
CHANSP	300	DATA	7	EOM CHARACTER	NONE
LAP ADDRESS	0	STOPS	1	NEWLINE	0D
CURRENT CHANL	6	AUTOBAUD	OFF	EXPAND	NONE
HOME CHANL	6	DCD CONTROL	OFF	XON	11,11
COMMAND	1B,7F	DSR CONTROL	OFF	XOFF	13,13
LISTEN	ON	DTR CONTROL	OFF	FLOW	XON,XON
PRIVILEGE	ON	DMODE	F,P	TIMEOUT	0
MAXSESSION	1	ECHO	OFF	EMULATE	NONE
PCALL	OFF	QUIET	ON		
PENTRY	BMC80	PASSWORD	OFF		

5.11.0 SAMPLE OUTPUT/RESULTS

A sample number of screen displays of the Expert Help Desk and Network Support database system were photographed as shown on the following pages.

It is not feasible to include all the displays that can be generated (thousands), therefore key examples are included.

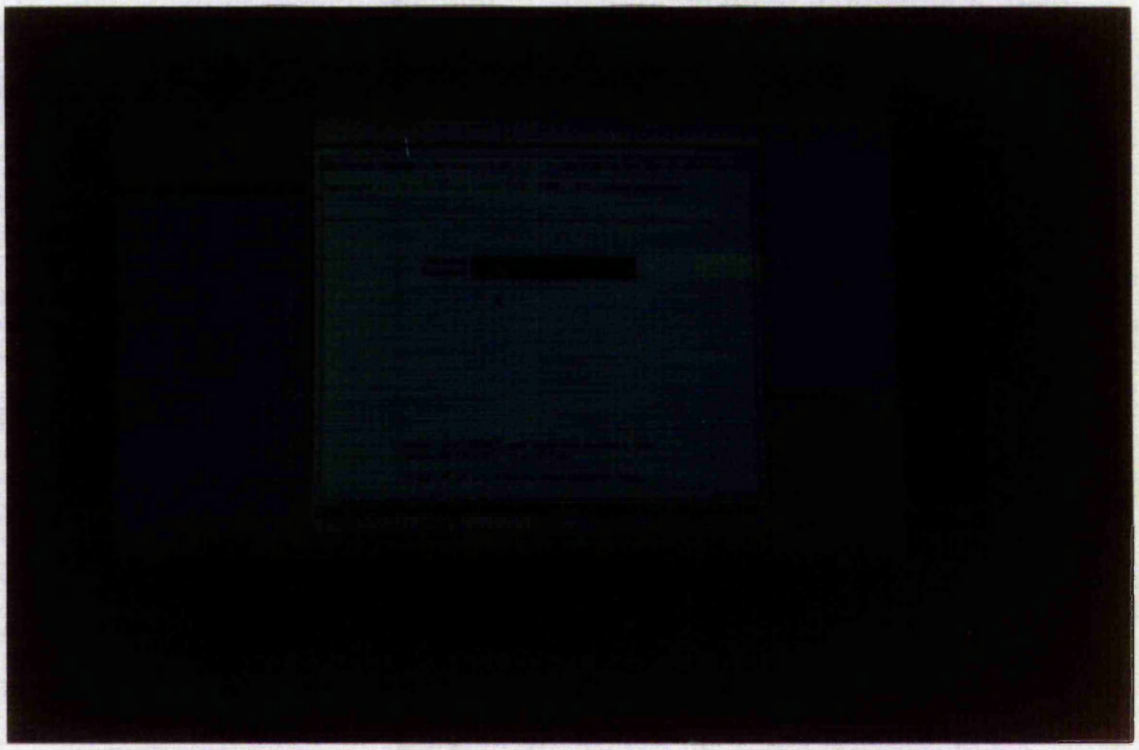


Figure 5.9

This is the main logon screen to enter the Expert Help Desk and Network Support Database system.

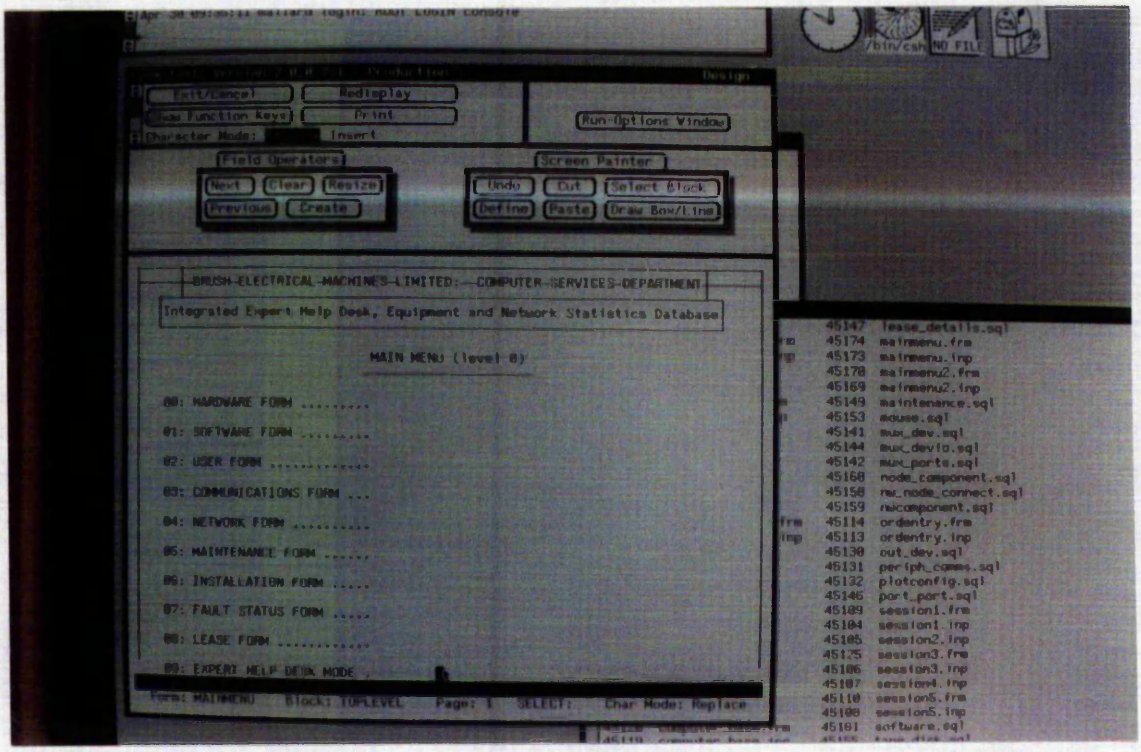


Figure 5.10

This is the main menu to the system. If an enquiry, update, addition or deletion of one of the listed entities is required then the user enters the corresponding number.

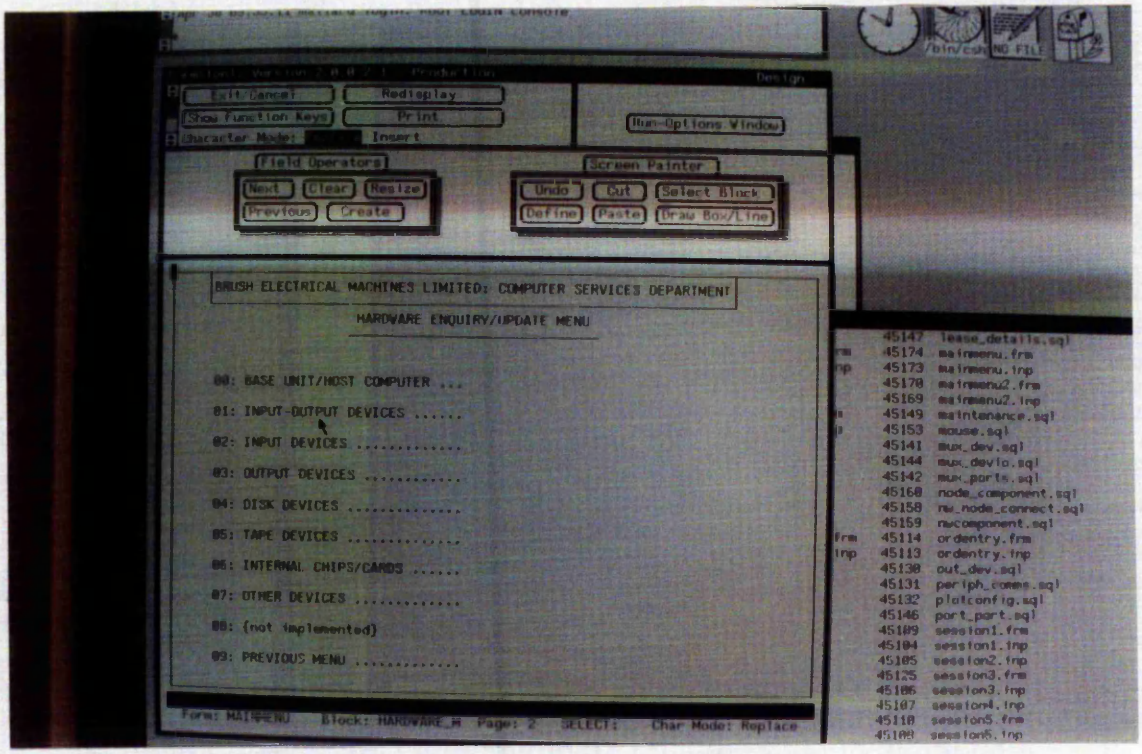


Figure 5.11

If the hardware form is chosen, 00, then this menu is selected. If an enquiry, update, addition or deletion of one of the listed entities is required then the user enters the corresponding number.

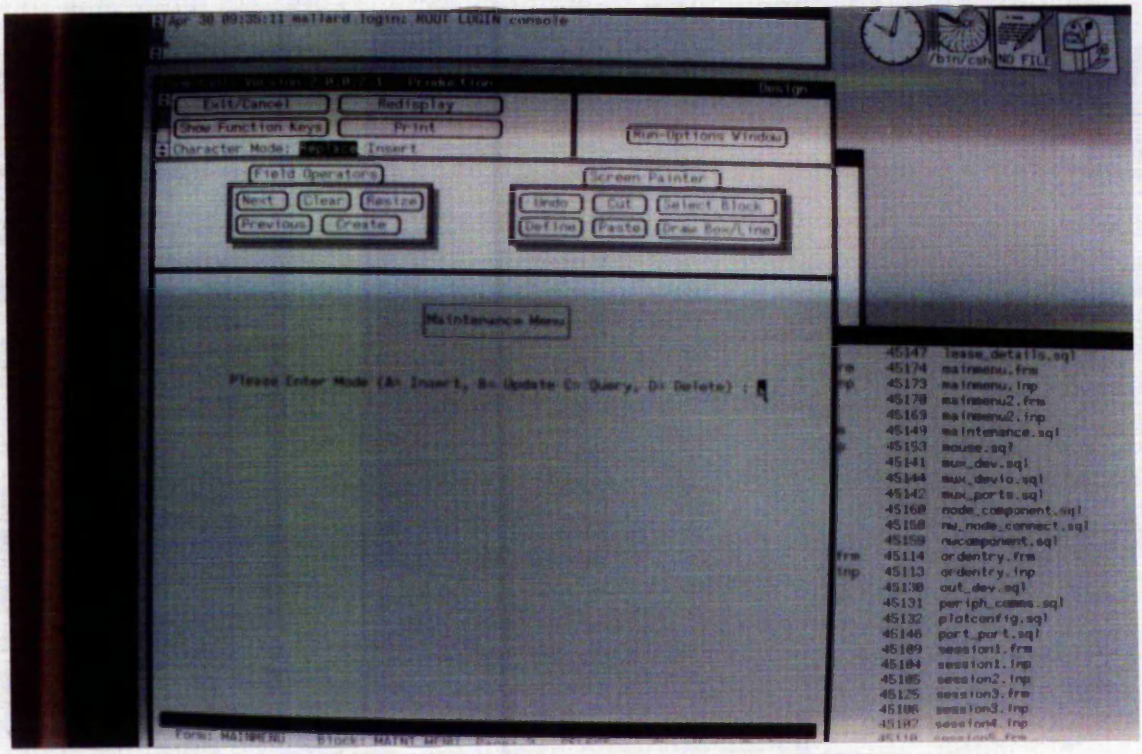


Figure 5.12

If the maintenance form were chosen then this menu appears. The user will specify whether he/she wishes to insert, update, query, or delete.

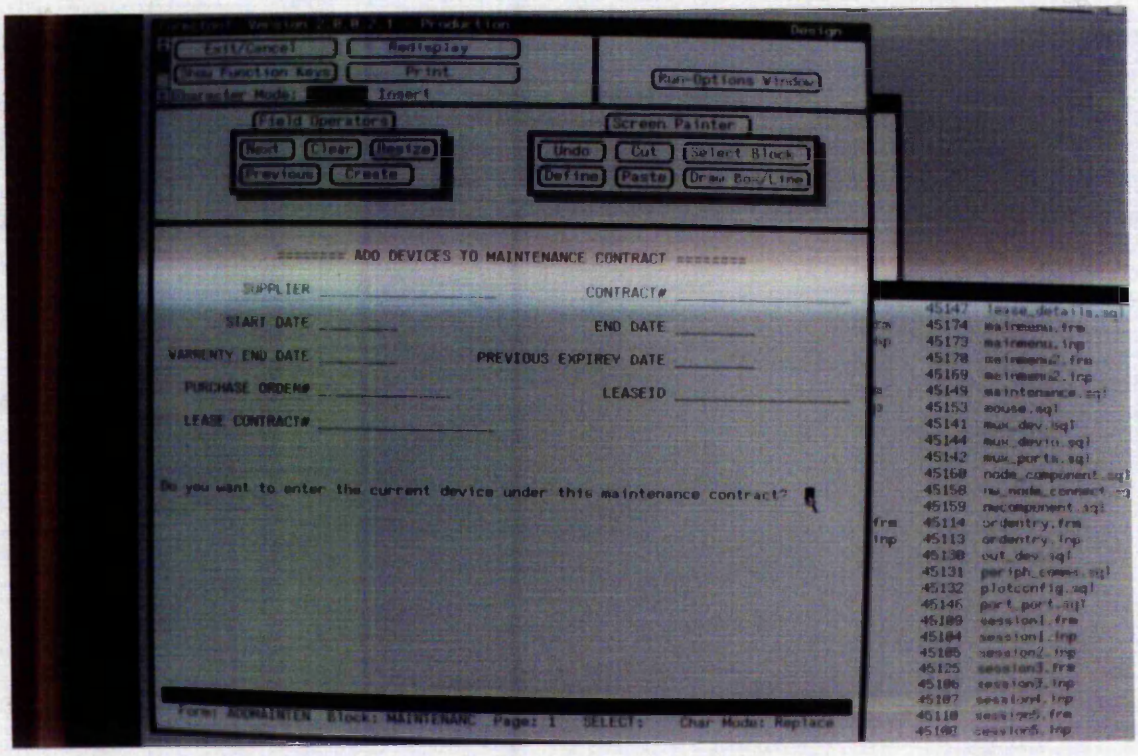


Figure 5.13

If the user specifies that he/she wishes to add a new maintenance contract then this screen will appear. The maintenance details that are entered will be associated with the device previously selected from any previous form. (The update form looks very similar).

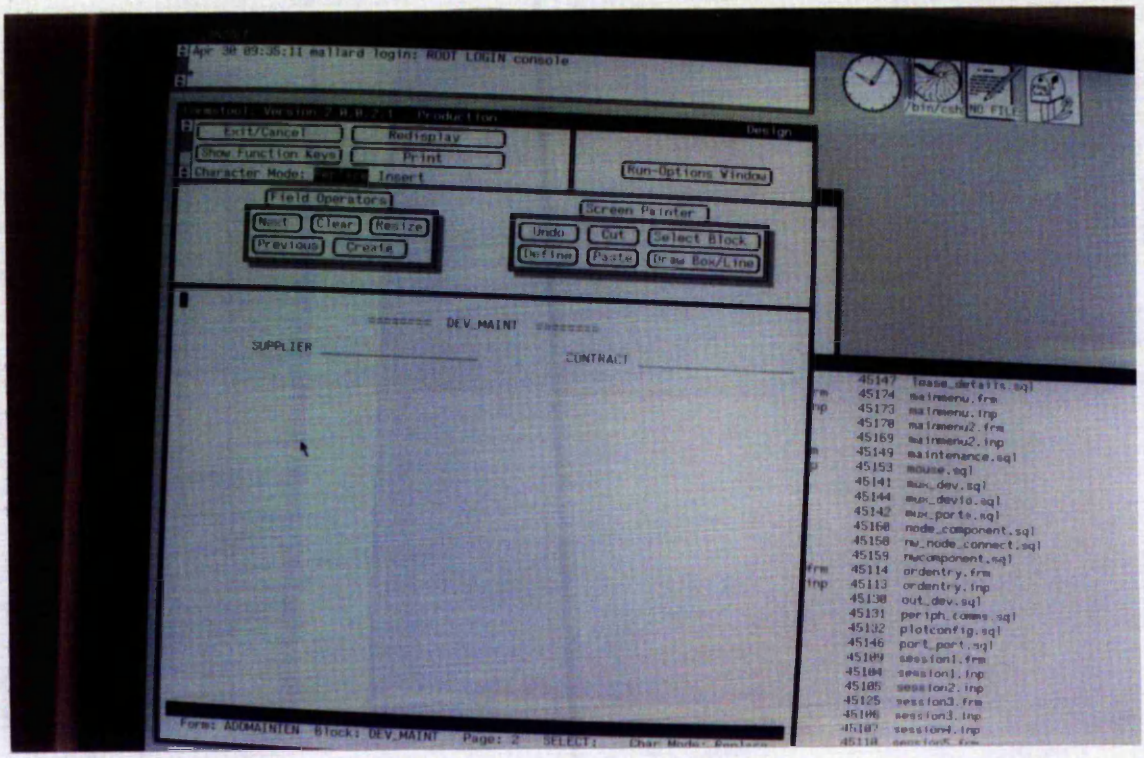


Figure 5.14

If the user specifies that he/she wishes to make an enquiry this screen will prompt the user to specify the maintenance supplier & contract number. For a list of unique names & contract numbers used already, the user selects the pop-up menu and selects 'Display Possible Values'. This technique applies to most field names.

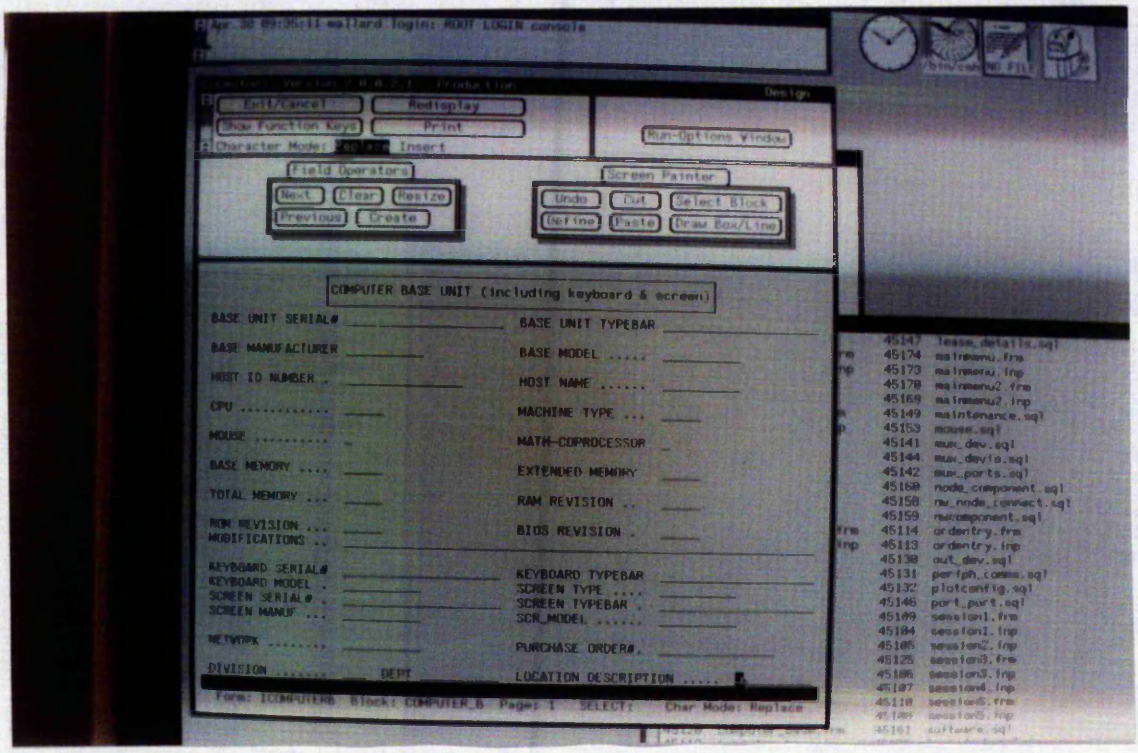


Figure 5.15

If from the hardware menu Computer Base Unit had been chosen then this screen will be displayed.

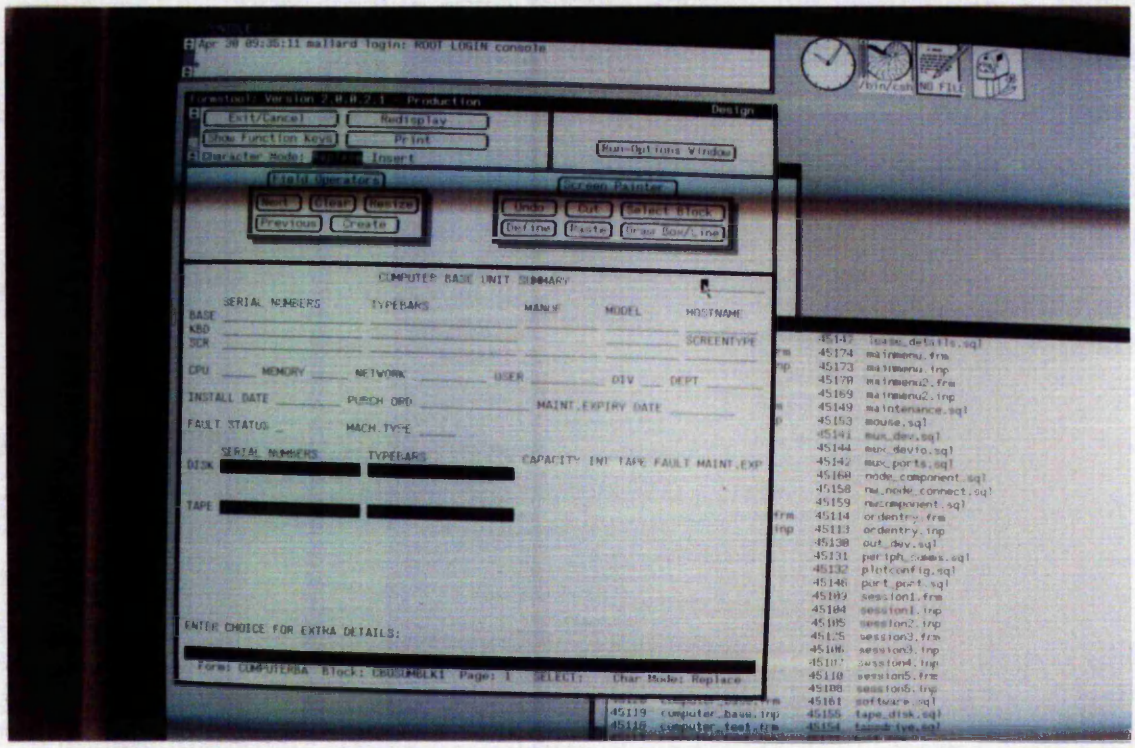


Figure 5.16

If a summary of a particular computer base unit had been selected this screen would be displayed. Details concerning the base unit itself and corresponding installation date, maintenance cover, user information, purchase information and fault status will be displayed. Also, any attached disk or tape devices and technical information will also be displayed in the 2 highlighted areas. If extra information on any item is required the screen display similar to Figure 5.15 will be displayed.

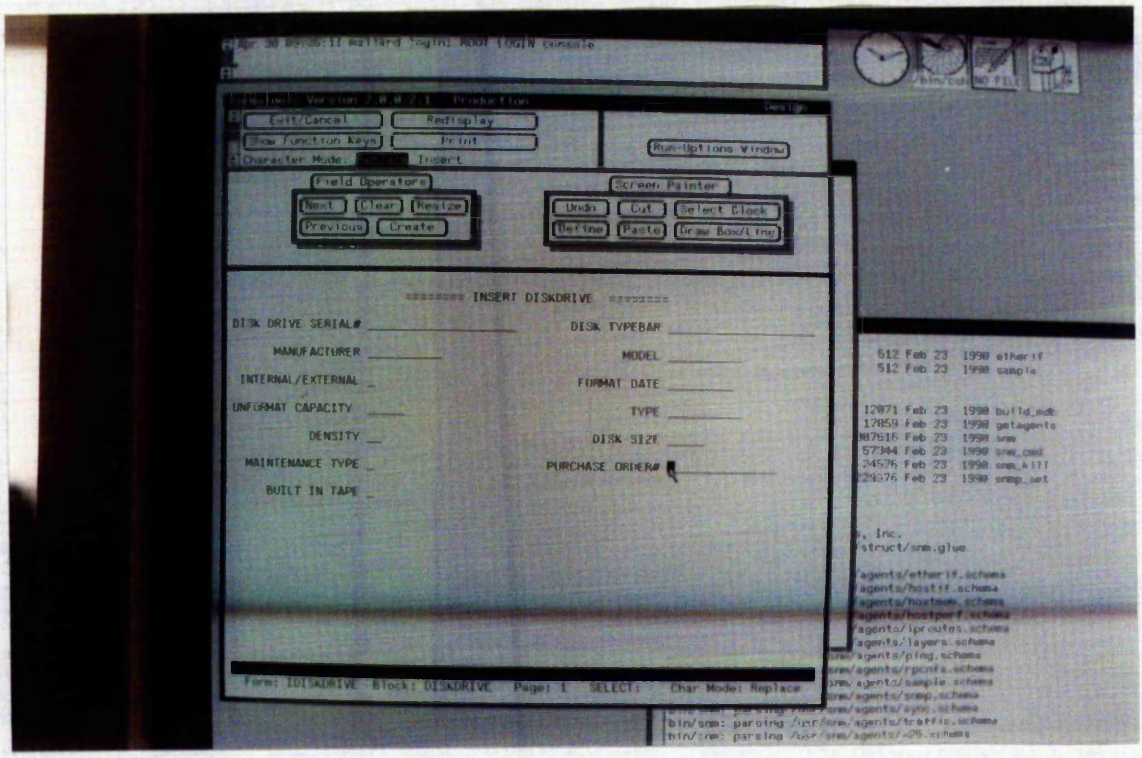


Figure 5.17

If details concerning the attached disk drive, or chosen directly from the hardware menu were required then this screen will appear.

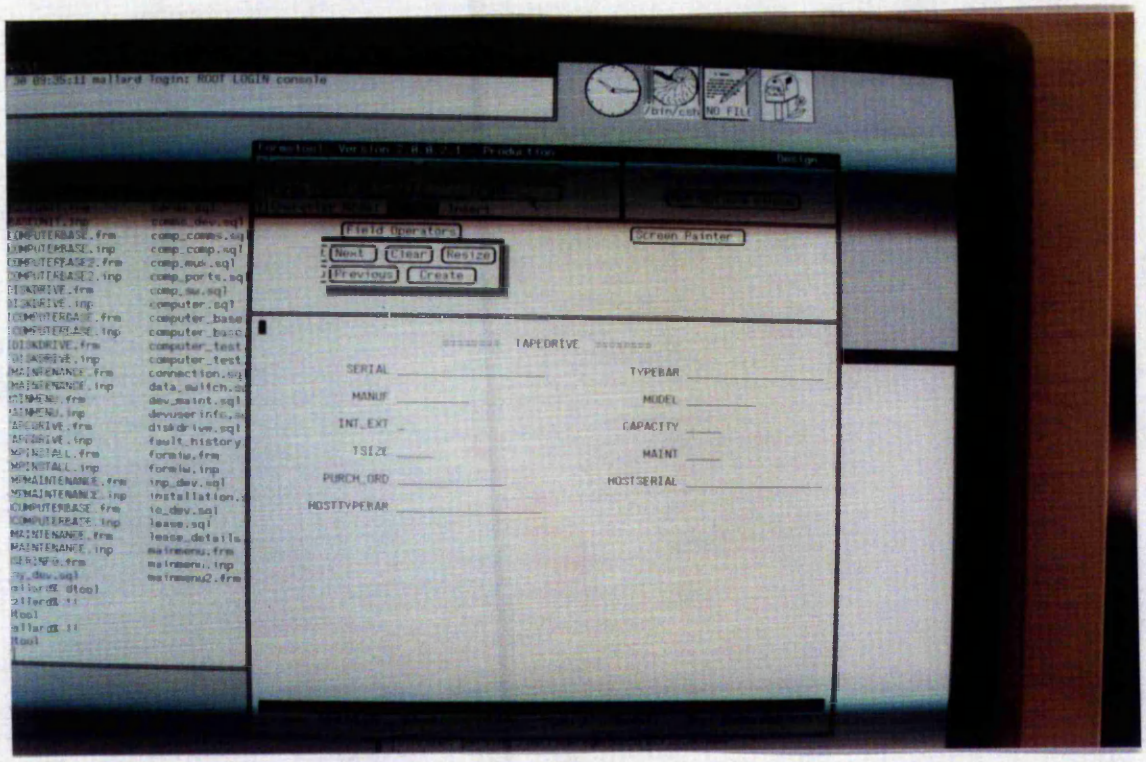


Figure 5.18

As in Figure 5.17 a similar screen for other devices is displayed, e.g. for a tape drive this screen is shown.

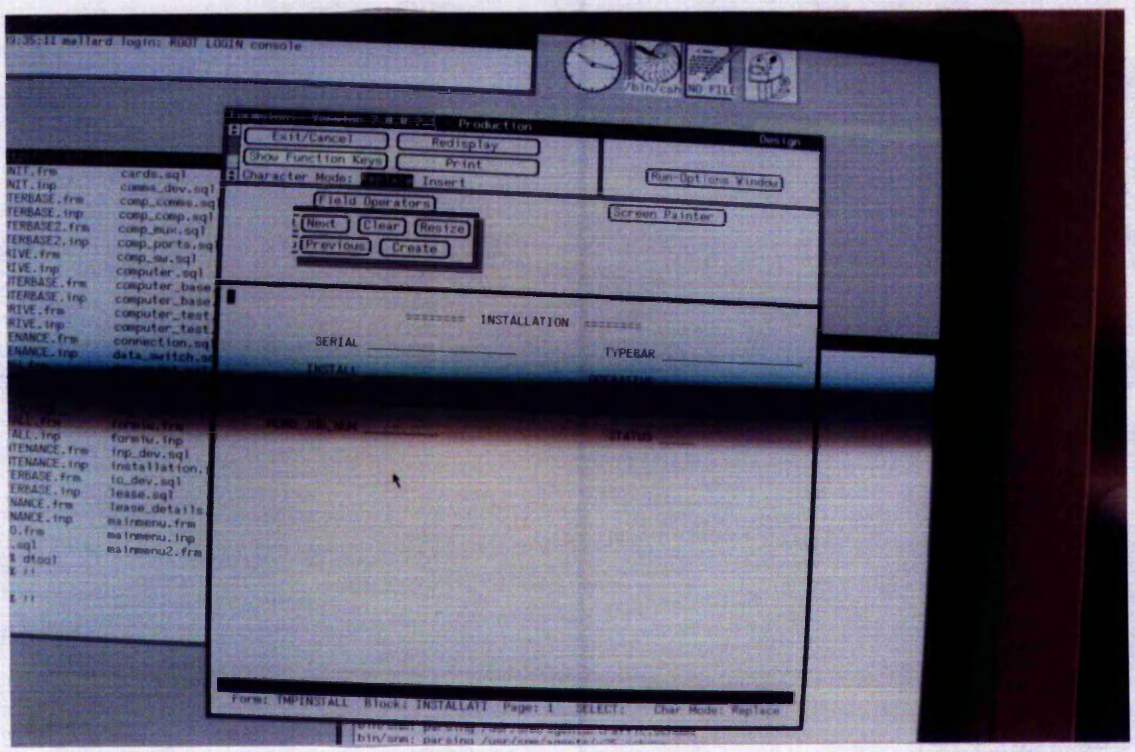


Figure 5.19

From a sub-menu or main menu, if installation details were requested this screen will appear.

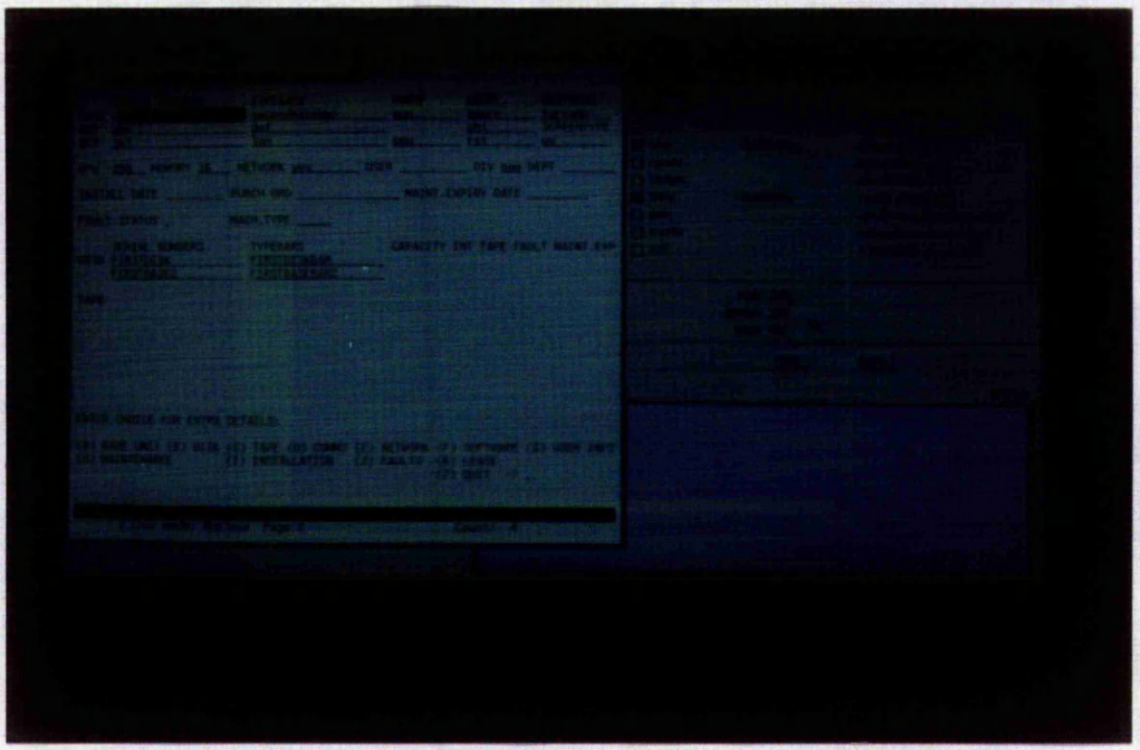


Figure 5.20

If an enquiry on a computer base unit summary is required this is the result.

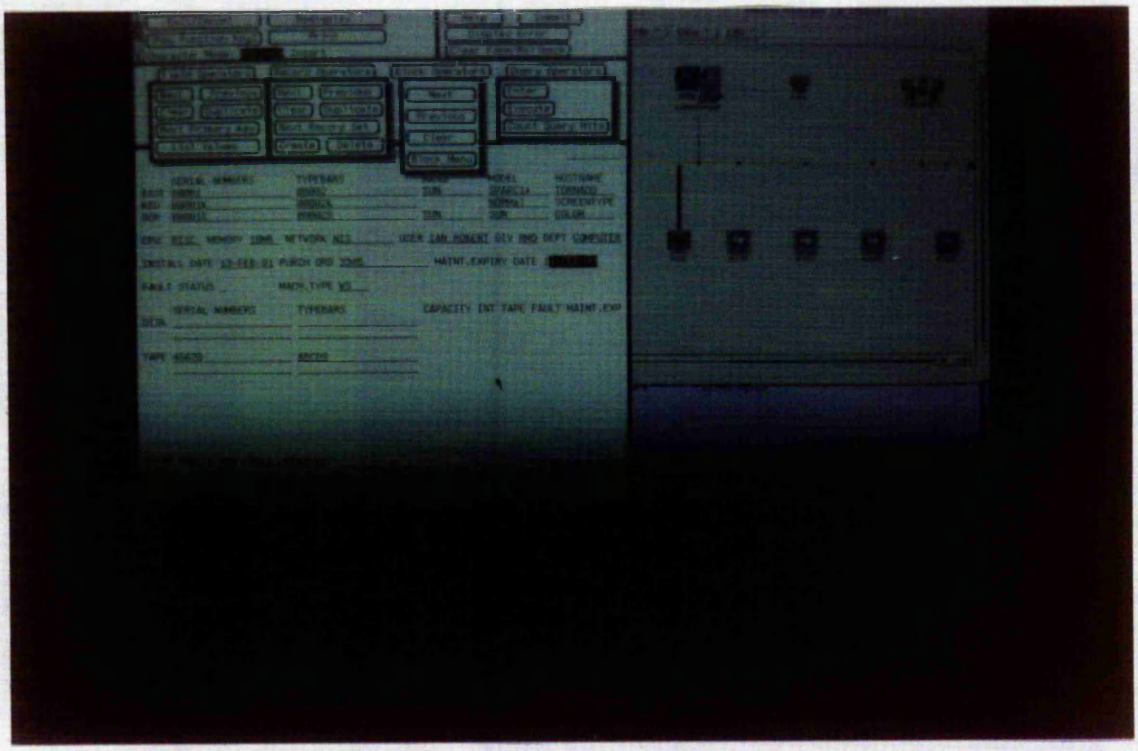


Figure 5.21

Same as Figure 5.20 but also shows that the Network Support system runs in parallel to an enquiry, thus providing a graphical and tabular output.

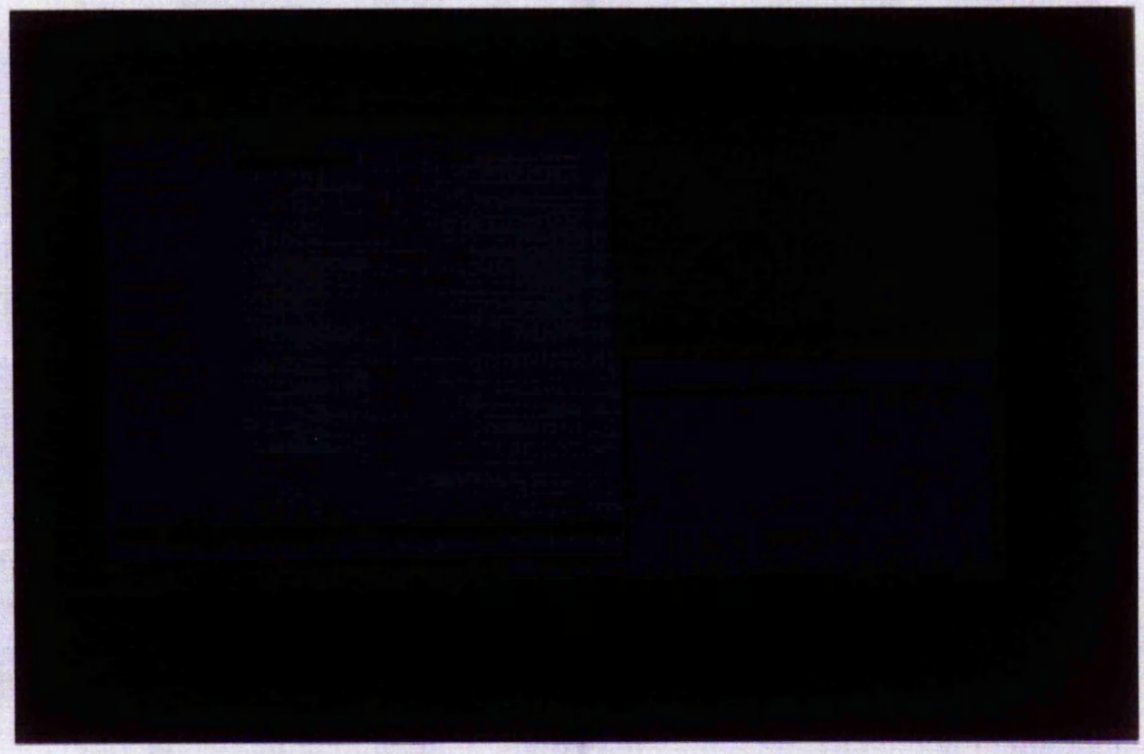


Figure 5.22

From the full computer base unit display any corresponding or related information connecting this to any of the items listed at the bottom of the screen A-K, can be selected.

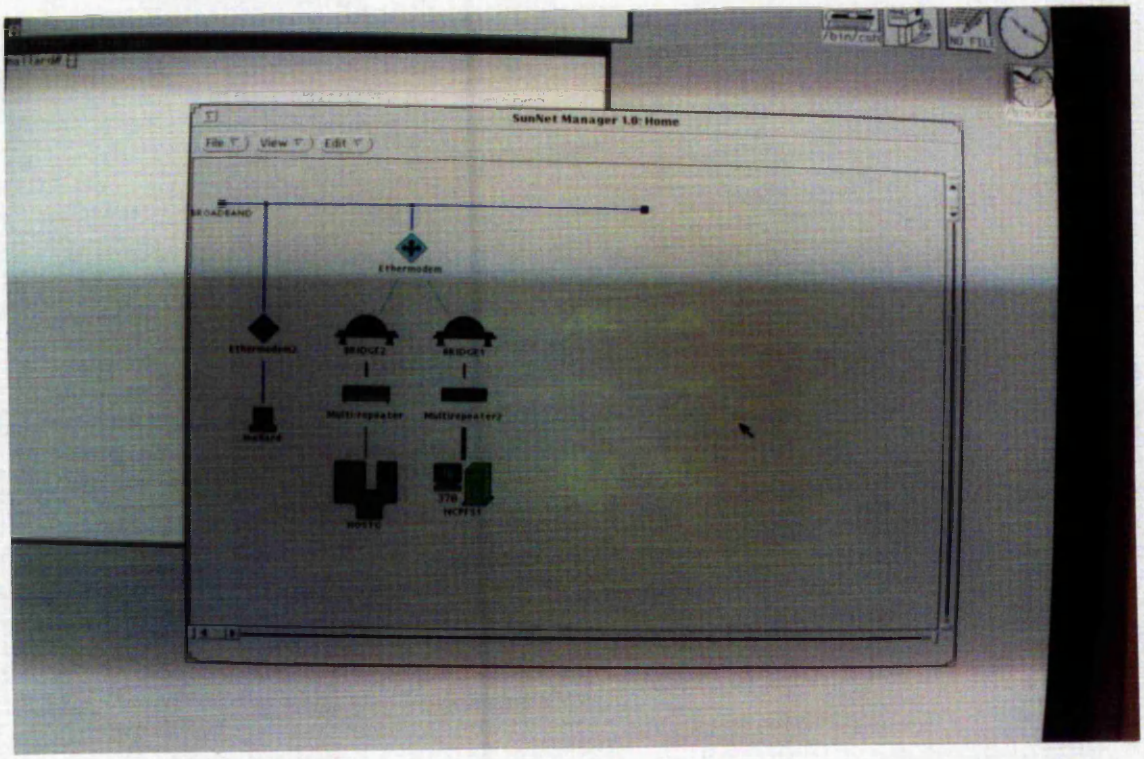


Figure 5.23

This represents Figure 5.3, the BEM Broadband Network head-end. HOSTG, (a DG mainframe), here represents all the DG mainframes in Figure 5.3 (for clarity of this photograph). The DG network traffic is being kept local to the DG domain and only going out onto the Broadband when necessary. This is accomplished by a filtering bridge, here called 'Bridge2'. The Ethermodem provides the tap onto the Broadband.

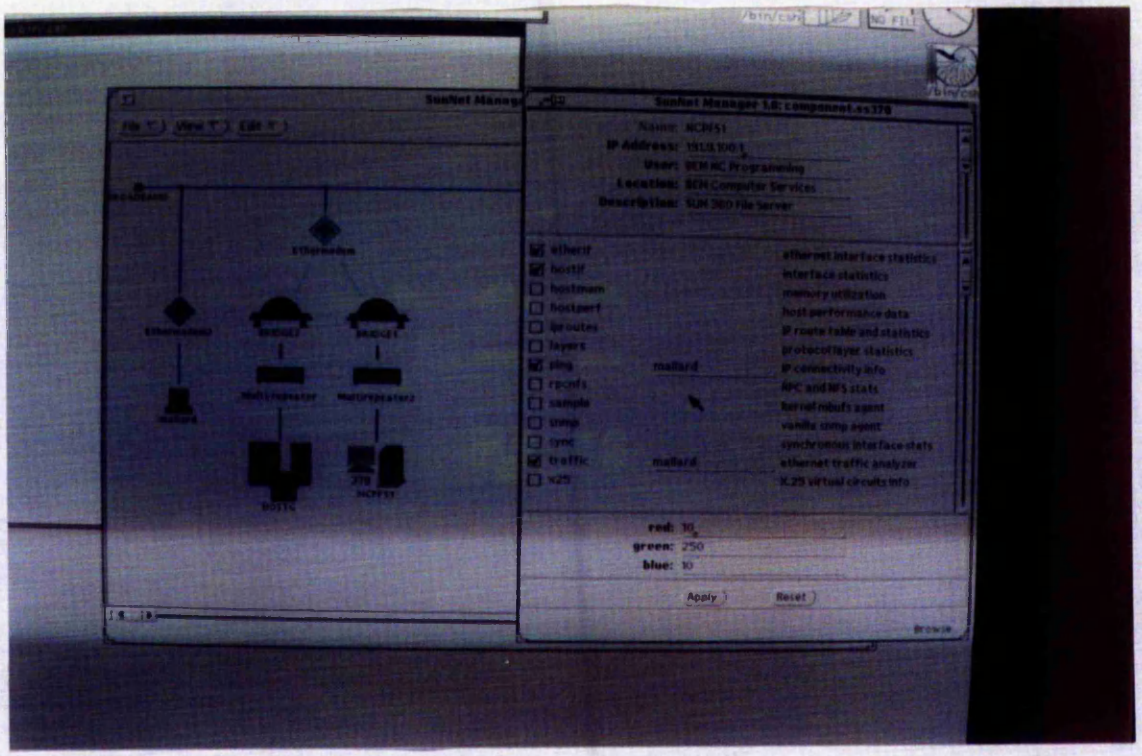


Figure 5.24

The Sun file server, NCPFS1, has been selected and configuration data requested. In this photograph we can see the internet address of this node, its location, etc. Also, a list of network statistic requirements.

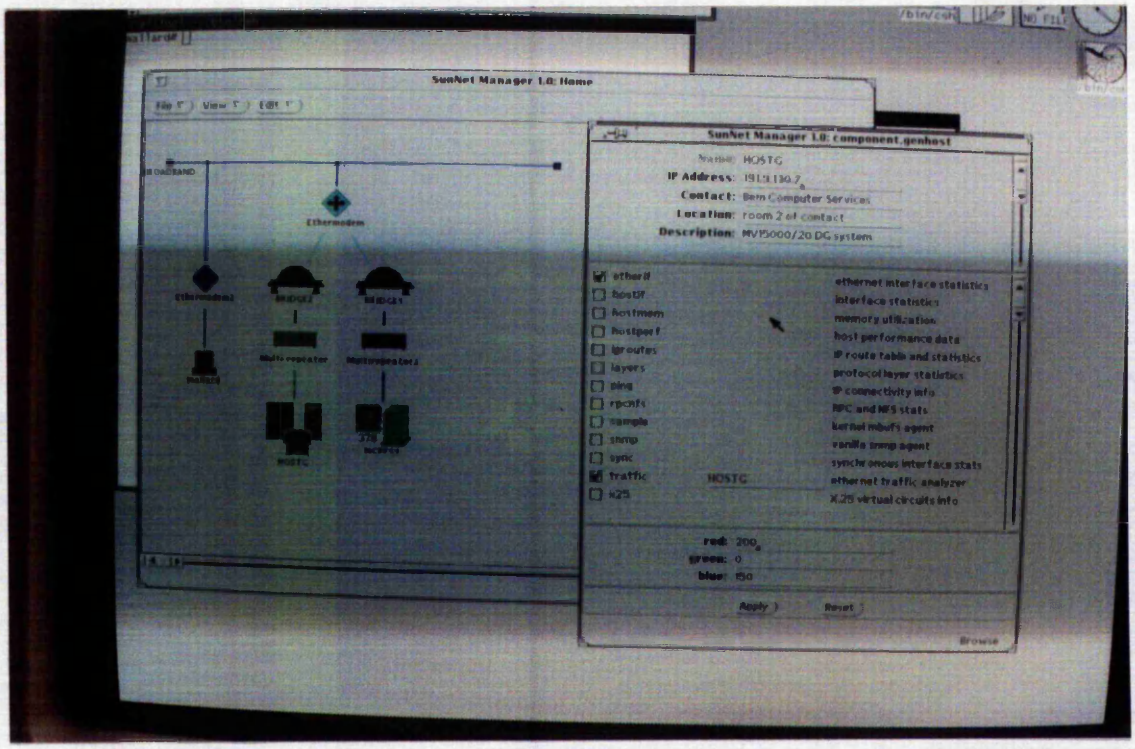


Figure 5.25

As in Figure 5.24, but configuration data for the DG HOSTG is requested. This is performed by clicking on the HOSTG icon and then selecting 'properties' in the pop-up menu.

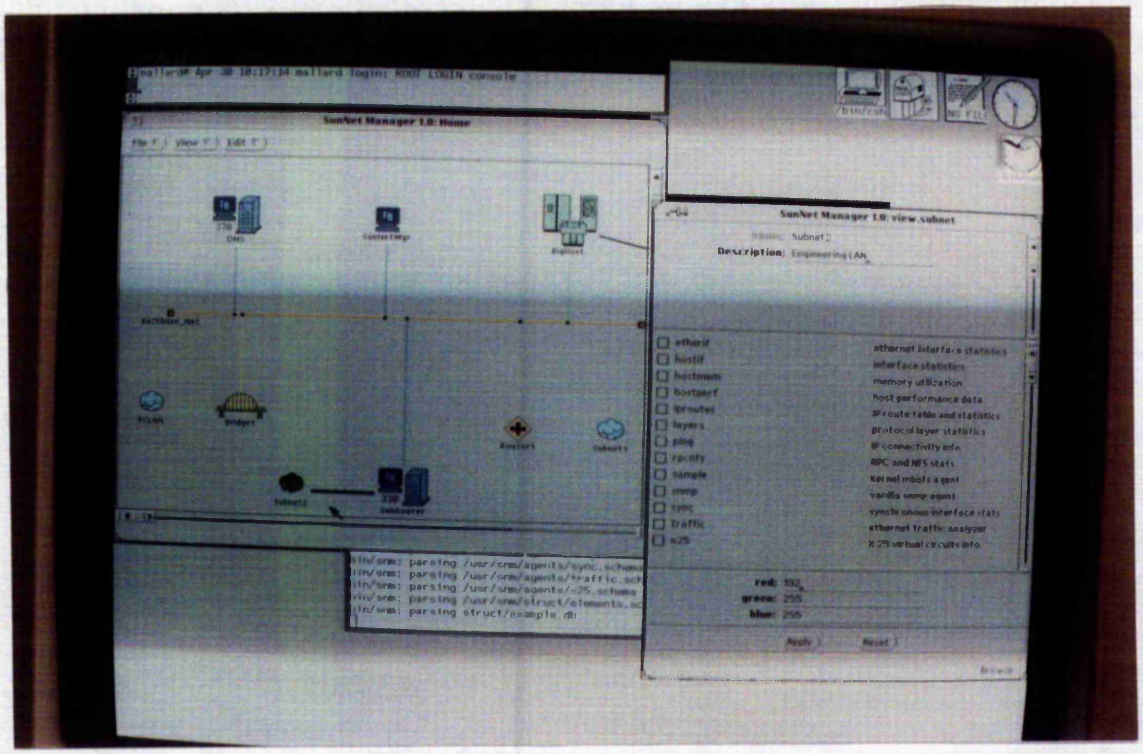


Figure 5.26

A larger portion of the network has been displayed here. A number of components can be fitted into this display but when more are required or are in another department then a 'sub-view' or 'subnet' is created. Here subnet2 represents the Engineering Department's Local Area Network (LAN). When this subview is zoomed in on, the result is Figure 5.27.

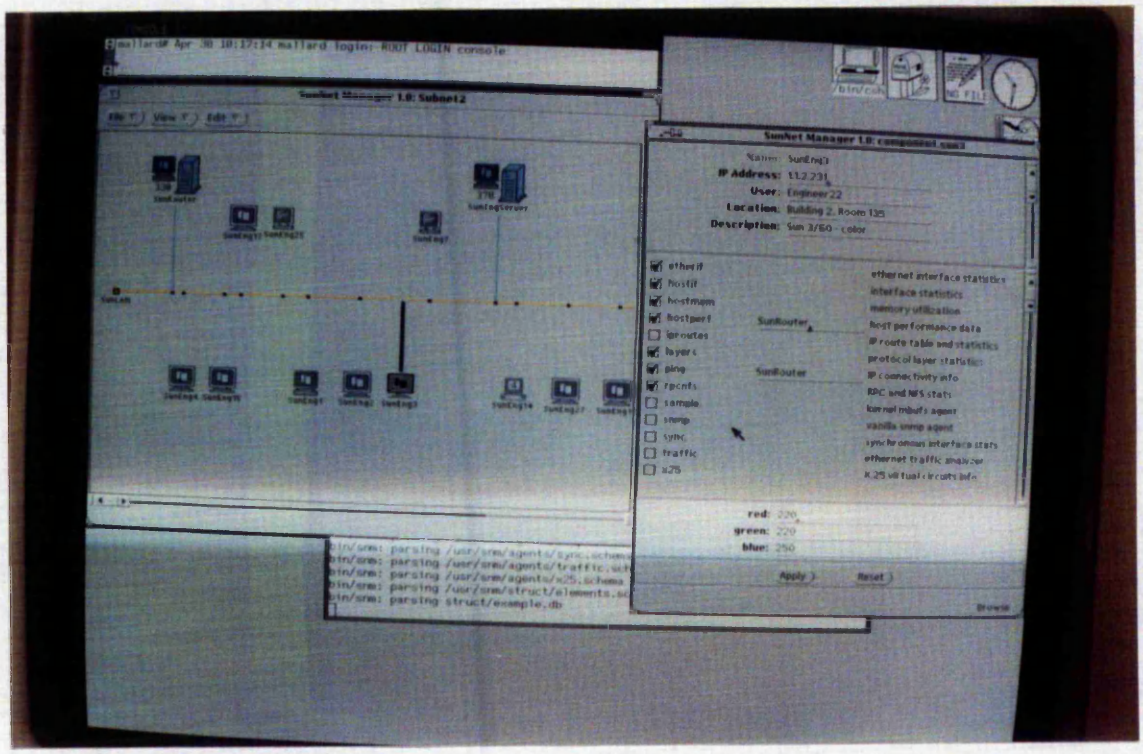


Figure 5.27

This shows the Engineering Department's LAN. We can zoom in further to a particular PC on this LAN and display its configuration as shown here, IP ADDR 1.1.2.231 and a list of statistics information required.

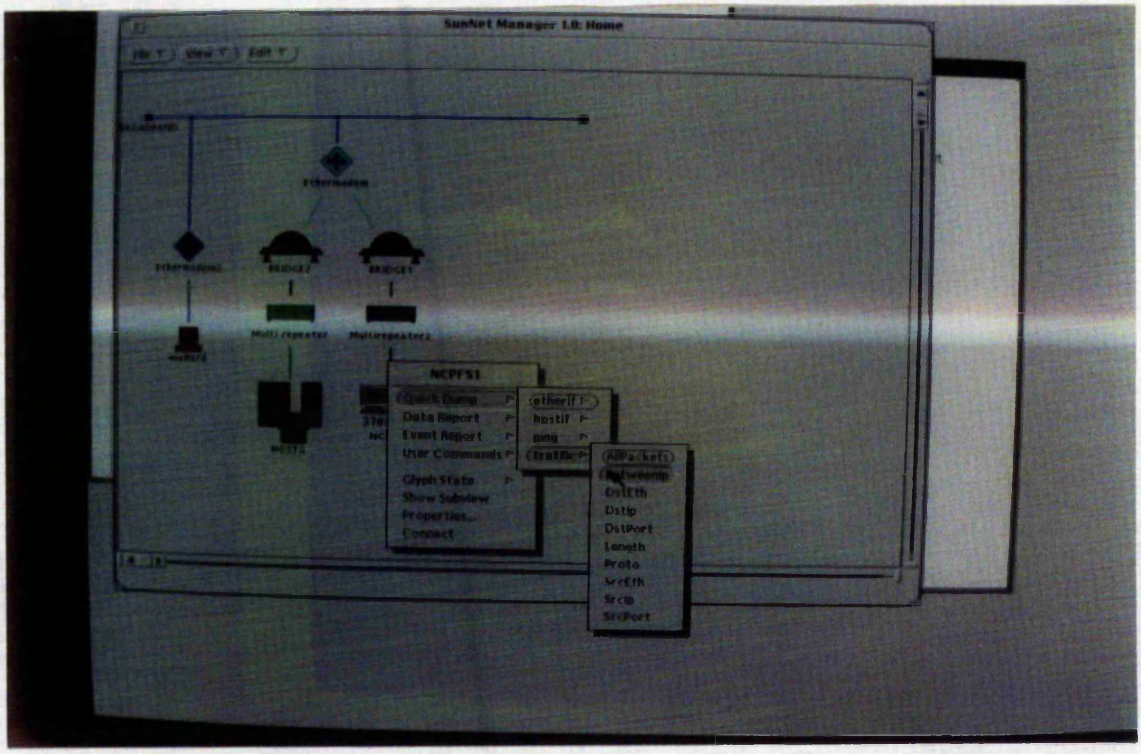


Figure 5.28

This shows the options available for producing network performance information, (see SunNet Manager manual). In this particular shot the Sun file server, NCPFS1, has been selected for monitoring.

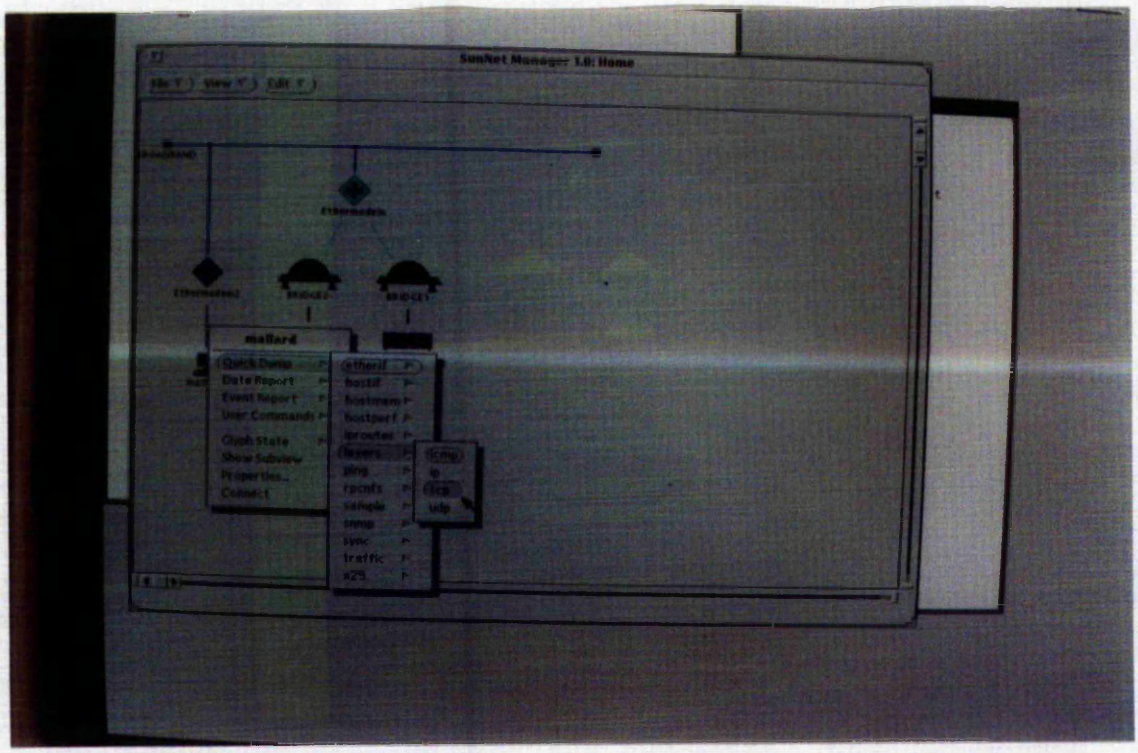


Figure 5.29

Here a workstation called 'mallard' has been selected to obtain statistics on its performance.

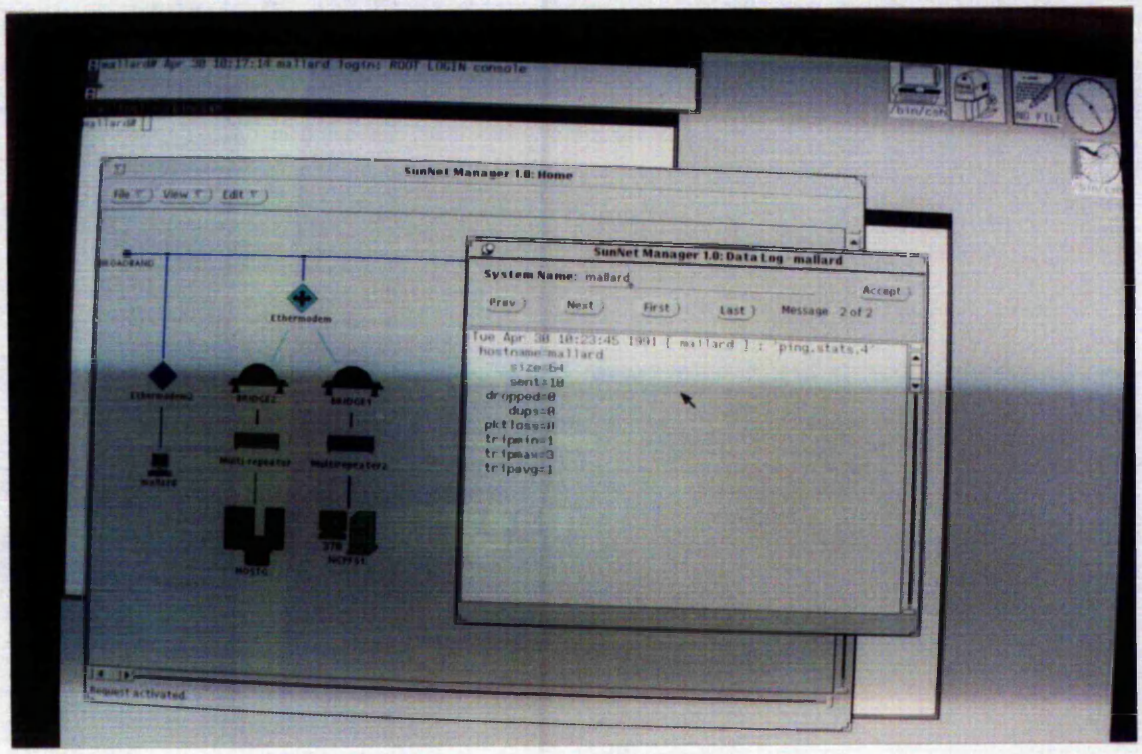


Figure 5.30

Network performance monitoring has been activated, (see bottom left hand side message in photograph). Here we can see that the workstation mallard has sent 10 packets of 64K bits without loss, error or collision in a time of .1 seconds.

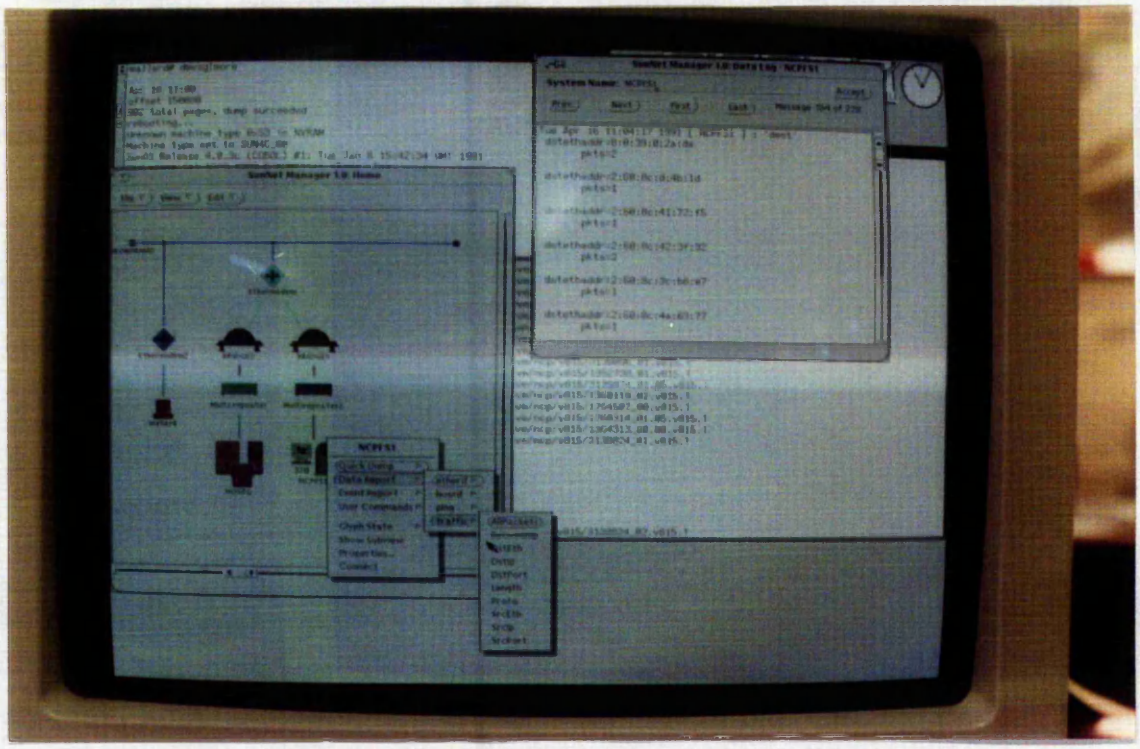


Figure 5.31

This photograph indicates a request to display the destination addresses of packets generated by the server NCPFS1.

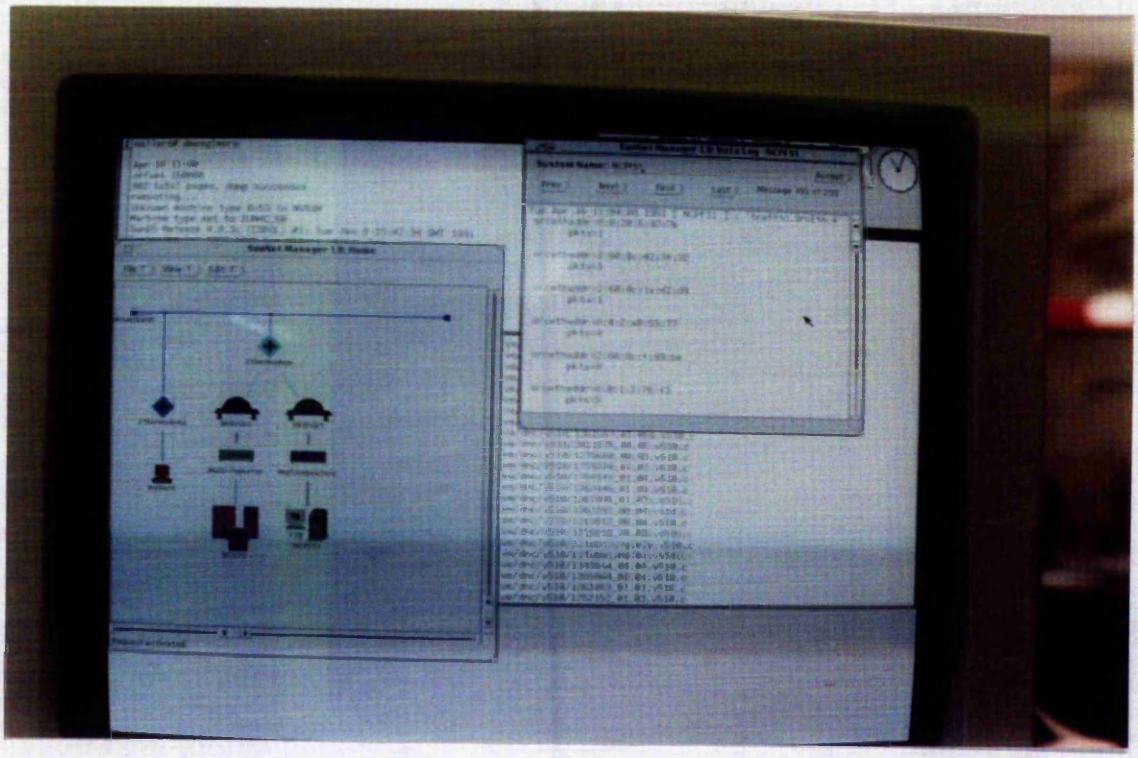


Figure 5.32

This photograph indicates a request has been made to display the source address of packets received by NCPFS1.

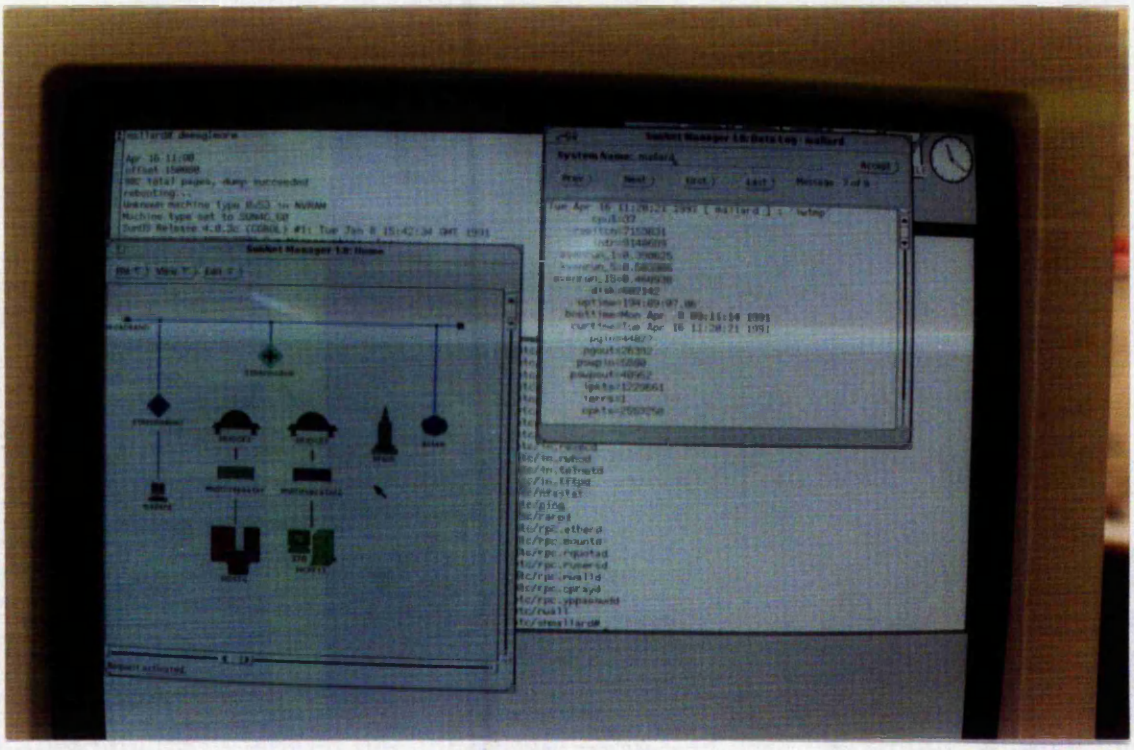


Figure 5.33

This screen display shows a request for performance information for the workstation 'mallard'.

CHAPTER 6

DISCUSSION & CONCLUSIONS

6.0.0 DISCUSSION AND CONCLUSIONS

6.1.0 DISCUSSION

The major requirements as specified during the investigation and analysis stage have been achieved via a combination of two things. Firstly, the implementation of computer based systems, as described in Chapter 5 - Implementation Results, and secondly, through the documentation and specification of procedures and working practices etc. thus creating a functionally standard method of working and storing and retrieving of information.

For example, standing instructions have been produced to specify the required methods of working e.g. Section 5.8.0 : 'Directory structure for a PC' and the network support system implementation section 5.7.1 : 'Standards for assigning internet addresses'. This particular document (or section) addresses the problem areas highlighted in Section 3.8.4.

In order to maximise the benefits of standardisation these standards must be first agreed and then documented, since if user departments are not aware of these standards how can they be followed. Thus, since communications is the key to any system, the following list indicates the proposed networking standards:-

OSI 7 layer Model	Implementation
Level 1 - Physical	ITL Broadband backbone, Thin co-axial segments
Level 2 - Data Link	Ethernet - CCITT 802.3
Level 3/4 - Network/Transport	TCP/IP, 3COM LAN manager for PC networks
Level 5 - Session	Telnet, FTP, NFS, Netbios
Level 6/7 - Presentation/Application.	

6.1.1 Meaning of Results

Using this system on a platform combination of SunNet Manager and SQL*forms, the user of the system can graphically display equipment connected directly to the company wide backbone broadband network, Figure 5.23 . The user could now 'zoom-in' on a particular department and display the network architecture within that department, Figure 5.26. The user could now 'zoom-in' on a particular component, (computer or network device), and display details (or properties) for that device (eg. user, location, cpu type etc.), see Figure 5.27. This provides a very clear view of all equipment in use, their function and future potential (good or bad).

As a result of this project the Computer Services department has for the first time been thoroughly investigated, particularly in the areas of user support. Procedures, operational methods and requirements for the support of computer systems and their users have been documented and thus a clear view of technical support functions provided along with a computerised system to perform them.

6.1.2 Scope of Technique

Few restrictions have been necessary in that the components of this system have been developed in a modular form, and integrated via a relational database (RDB). This allows the development of new or existing sub-systems without effecting the core system. As long as all the data is stored in the RDB then all sub-systems can communicate data, in a standard form, with each other.

If for example a new function is required to be performed, then database tables and relationships can be easily created and a SQL*form designed to perform the necessary function which will manipulate the newly created table. Data available in other tables can obviously also be used. The sql*form provides a standard interface thus making it very easy to train or learn how to use it.

6.1.3 Problems Encountered

During the early stages of this project, the investigation and analysis phase, there was a great temptation to speed up by skipping over vital areas to be investigated or to only touch lightly on problem areas instead of thoroughly studying them. This temptation originally arose as a result of being buried under mountains of paper work, facts & figures, and the slow process of studying an area and interviewing people. The lack of results as the deadline approached further increased the temptation but fortunately was kept in check until all the facts were known in order to make accurate judgements. All credit is due to the lectures on systems analysis and design which warned of this danger, I was ready for it... just!

Data entry was very time consuming, possibly more so than expected. It was no doubt error prone in the areas of collecting the original data as apposed to entering it into the database system. This is due to the very large numbers of equipment distributed over a very large area, some very dirty and thus difficult to read off identification information. It is also difficult to gain access to a lot of areas after 5pm or when the equipment is in constant use.

These items of equipment breakdown, and need replacing. This requires that any database entry for this item be modified, thus creating more work to do, (This highlights one of the main reasons why a paper based system to keep track of equipment is doomed to fail from the start.) Hence, this implementation was fraught with having to constantly amend data entered into the system. To improve this situation the data has to be collected as quickly as possible before items are moved, changed or modified in some way.

One of the main problems involved in the creation of the database, and hence all sub-systems, was the ability to uniquely identify any item to be stored in the database. After many meetings with Computer Services staff and other outside contacts, the approach adopted is that used by ICL UK Ltd, who use two identification markings on **all** their products. ICL have a serial number and a typebar code printed on all products, software, hardware and documentation. This approach required that the serial number of all items on the BEM site were recorded, and for those that did not have any identification markings one was generated, and a secondary label generated for any non ICL item. (ICL is one of BEM's main suppliers of computer hardware. ICL PC's are the company standard). In order that an item's serial number and typebar code can be distinguished new labels were attached to all items as they were entered into the database.

SQL*forms allows the programmer to build up complex routines using SQL type statements embedded in each individual field of the form being designed. These are called triggers, in that when the field is referenced it triggers the associated routine which is then interpreted. Although SQL*forms allows very complex routines to be developed in very much less time than if it were designed in a 3GL such as Pascal, it is does not encourage or even allow a structured approach to developing the form. However, each form is completely self contained and independent of any other form thus providing a very modular design.

The SQL*forms package used (version 2.1) provides only very basic facilities for creating triggers and does not allow the printing out of trigger definitions, (this has been addressed with the latest version of SQL*forms 3). This is due to the fact that the programmer is expected to design, develop and implement his/her forms application interactively on the computer and not on paper first, other than a rough idea of what database fields are required to be displayed. However, an ascii format file is created by sql*forms which contains not only the trigger definitions but all control information such as the positioning on the screen of fields and many other attributes. This file for just a single form can be very large and since most applications have more than one form very large files are generated. This system uses approximately 25 forms (not all are used directly by the user) and a total file space of about 3,000,000 characters. Although this file can be interpreted it is not really very readable. An example of this listing is given in Appendix O.

6.1.4 Inadequacies of Apparatus

One of the main problems was that of learning SQL*forms from the manuals without having a computer to practice what I was learning. This arose as a result of a very late delivery of the computer system required upon which this system has been developed.

To obtain screen dumps of a Sun workstation is not possible unless the right software and hardware are available. To obtain screen dumps of graphics etc. an ink jet printer is required. In order to scale the screen display onto the printer a public-domain software package is used, (called SnapShot), which create a raster format file of the specified regions of the screen. This file must then be filtered (performs the scaling) before output to the printer. At BEM two departments use this technique, using a software filter specially written for BEM by Sun MicroSystems. However, it was not possible to use either of these systems to generate my screen dumps because they are in constant use, and also problems with licensing the software on other base units.

A camera was used to produce a sample of the output generated by this new system, as shown in Chapter 5. A fixed focus camera was initially used but the photographs were a bit underexposed. Finally an SLR Pentax camera was used which produced the best results once I had learnt to use it properly.

6.1.5 Errors

This new system has not been tested to destruction. Within SQL*forms there is no systematic way to test all routes through the forms. Therefore, there are likely to be a number of 'features' yet to be discovered. However, every precaution has been taken to ensure that no duplicate identification (id) data is entered into the database. A check is made on every serial and typebar number entered. To avoid inconsistencies (referential integrity) once an entity has been entered under a particular id number the corresponding details can not be disassociated from its id. To update id information all references to this id are deleted first and then the information re-entered with the new id information, (see Conclusions).

6.2.0 CONCLUSIONS

The system appears to perform very well and making full use of the windowing facilities it is very easy to access several forms (or sub-systems) at once and pass data between them.

Using a few standard packages or tool-kits such as SQL*forms and SunNet Manager (SNM) on a SunView (or X windows) platform provides the user of it a very easy to use human-computer interface. The SNM is presented with an object-oriented interface which may be tailored to depict the users own preference. These windows are based on Open Look's Graphical User Interface, (GUI).

Using standard packages in this way eliminates the dependence on the designer or implementor of the system in terms of system maintenance, which typically caused many problems in the past when the designer left the company and all the badly documented systems left behind were very difficult to maintain especially if the programmers were not familiar with the language used.

Using these commercial standard products / packages as building blocks for a more complex application ensures that a lot of people will be familiar with the language / product and thus able to maintain the system easily if required. Also, development time is reduced significantly through the use of a number of in-built utilities.

- However, the disadvantage of this approach is a very real one, that of 'Version Control'. This is where a number of interacting products must be compatible with each other in order to operate correctly. However, if a particular product is upgraded to the latest revision say, (to overcome bugs), then it may become incompatible with the other systems or even the operating system. This results in either upgrading the other packages (which itself has a similar effect) or downgrading the package until a patch can be made.

- A lot of disk and memory is required to support all these different products.

- And finally, another problem occurs if a fault develops in one of the packages. When reported to the maintenance / support firm they have the tendency to blame the other packages.

Throughout this project the importance of standards has been expressed. Some of the benefits of such standards especially in area of Open Systems and distributed computing are listed below:-

- Computers can communicate and work together
- Communication will be possible between systems irrespective of the application
- Improved management and sharing of information
- **Less duplication of effort**
- Ability to trade electronically between user, supplier & customer
- Reduction in training costs
- **Reduction in support requirements and costs**
- **Better support services**
- Greater concentration of expertise and assistance
- Flexibility of staff
- Increased availability due to duplication
- Greater choice of software
- Not 'locked-in' to a single supplier
- Negotiating strength to buy products at best price
- A predefined specification for suppliers or users when discussing hardware or software
- Ability to expand and change easily
- **Common user interface**

For this to actually work the computer systems which support it are going to be relatively complex, which means that the skill level and resources for its support, service and maintenance are going to be greater. Thus the importance of this project to maximise the productivity of the support services provided by BEM Computer Services.

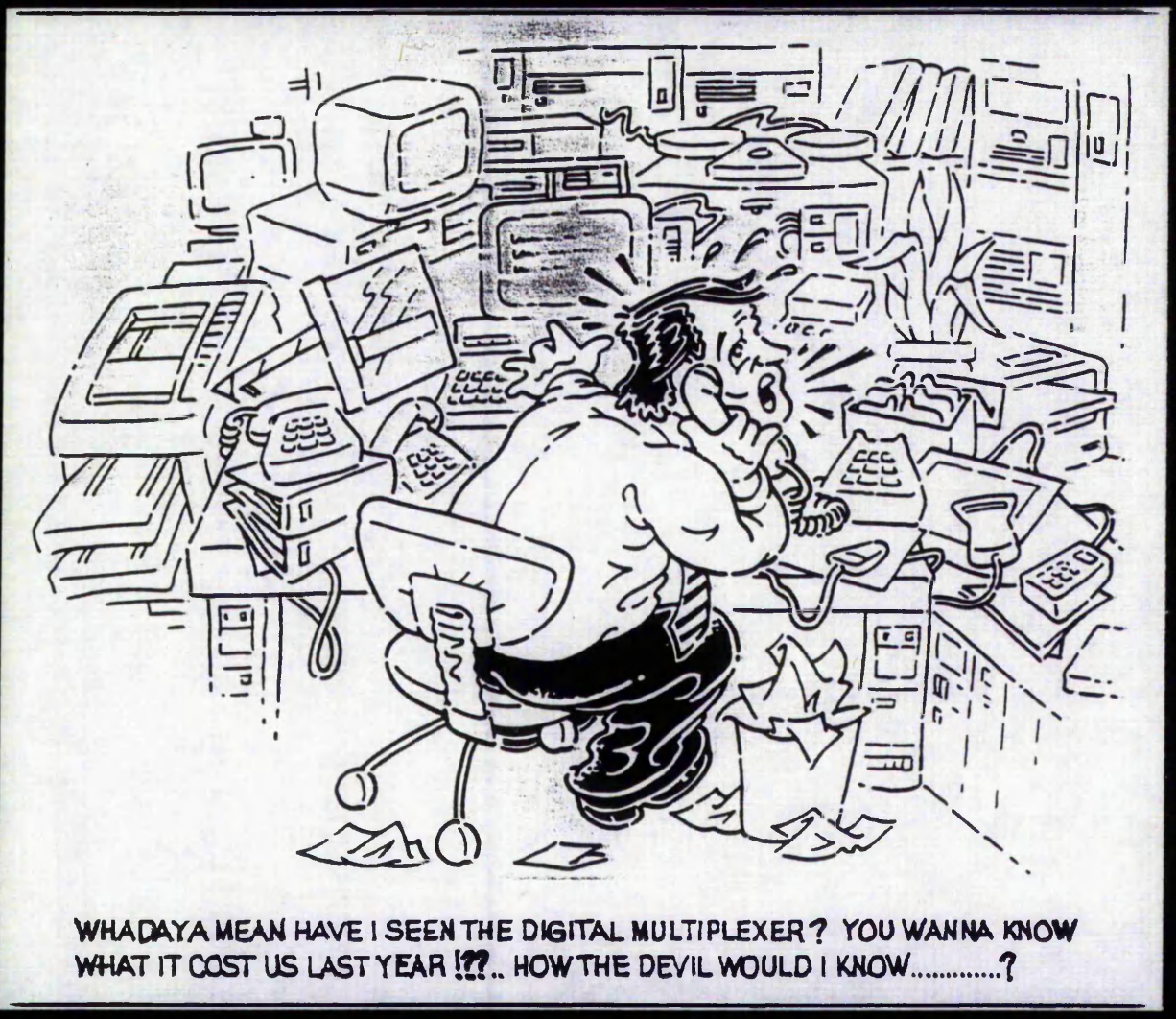
6.2.1 Future Work

As mentioned in the discussion section one of the problems encountered during the project was that of data entry. To enter data for every piece of equipment on the BEM site and then to keep it updated is a very major task. One solution would be to employ someone full time to keep the database upto date. However, a more automated solution is to use an electronic data capture device, which will electronically capture data at source and update the database automatically. One such available system on the market to do this is 'HardCat' which consists of a hand held keyboard type device and a light pen for reading bar codes, see Figure 6.0. Using this method the problems mentioned before concerning the unique identification of equipment would be eliminated by attaching bar coded labels onto each item containing its own id. This Asset Monitoring system is only implemented on a PC based system but it would not be too difficult to link this PC to the workstation database via a network, in order that data is recorded in the Oracle RDBMS, thus allowing full integration.

Other future enhancements would be to store records of entity information that is deleted in a 'clipboard' type table so that it can be 'pasted' back to the database table it came from with new id information say. This would eliminate the need to re-enter information when updating id header information.

Figure 6.0

HARDCAT GETS YOUR ASSETS UNDER CONTROL



WHADAYA MEAN HAVE I SEEN THE DIGITAL MULTIPLEXER? YOU WANNA KNOW WHAT IT COST US LAST YEAR !??.. HOW THE DEVIL WOULD I KNOW.....?

IF YOU CAN'T LOCATE YOUR ASS

Why HARDCAT is your choice in Asset Control.

HARDCAT is a complete, simple to use system for managing your company's assets. Anything that can be labelled with a barcode–anything from a computer keyboard to a forklift truck–need never be difficult to keep tabs on again. As well as information on the location of equipment, HARDCAT instantly answers important asset management questions such as:

What assets do we have?
Who are the suppliers?
Do we have a maintenance agreement?
What is the performance history of a machine or group of machines?
Have we had problems?
What are our performance figures on our equipment?
What equipment is missing?

HARDCAT Rev. 3

Barcode gives you Speed, Accuracy and Simplicity.

With HARDCAT, each asset is given its own identifying barcode label, which is read by a handheld data collection terminal. The terminal is small enough to be sent by post or courier, which takes the worry out of remote location audits.

With HARDCAT, staff no longer need specialist knowledge to audit your assets, as there is no need even to identify the equipment. Even an untrained operator can use HARDCAT: you don't need to be a genius to wipe a wand over a barcode.

Take the Pain out of Auditing and Financial Control.

HARDCAT gives you an easy, low cost means of financial control. It puts information on purchase, lease, rent and sales figures at your finger tips, and it's accessible by supplier or by asset. All financial statistics are up to date and indexed for easy reference.

HARDCAT cross references all your information instantly: hardware to supplier, components to hardware, hardware to location, problems to hardware, or whatever details you require.

HARDCAT features password protection to ensure your financial information is hidden from users who need data on equipment performance. Equally, performance details are protected from users who only require financial information.

HARDCAT allows a complete audit of equipment performance, highlighting crucial problems and downtime, and dramatically simplifying cost control.

Print or View all the information you need.

HARDCAT produces well presented reports and manuals in A4 format, indexed and ready for binding. You choose the level of information required, from a brief report to a complete catalogue. A built-in editor lets you insert descriptive text on usage, supplier, hardware, location and problems. HARDCAT also presents data in easily understood graphic formats.

HARDCAT USERS IN

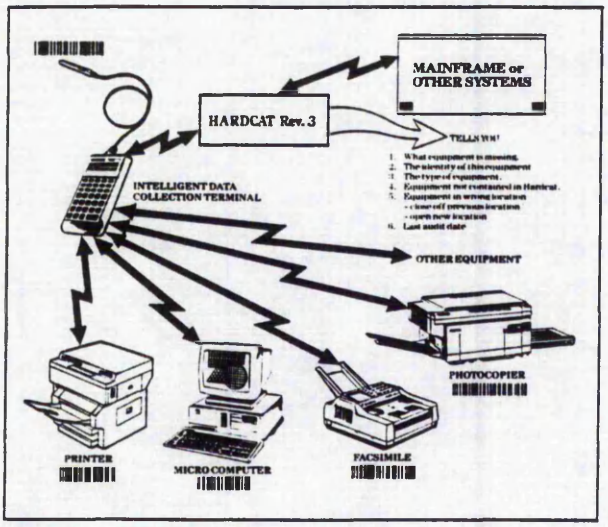
Aerospace Technology Australia • Australia Post • Australian New Zea
Colgate-Palmolive • Colonial Mutual • Department of Community Service
Farrow Computer Services • Fluor Daniel Australia Pty. Ltd. • Gillette Pty. Ltd. • A. C. Goode • Hero Electronics • Department of H
Attorney Generals Department • Australian Lawrence & Hanson • Central Mapping Authority • Mazda Motors Pty. Ltd. • Bureau of Meteorol
Peat Marwick Hungerfords (Vic. & NSW) • Permanent Trustee Company • Price Waterhouse • Public Service Board • Road Construction Aut
Titles Office • Bureau of Transport Economics • Department of Transport & Communications • Melbourne University • Vicomp
Australian Road Research Board • Costain Australia Limited • ACI Packaging Group • ANZ DP Operations • Department of Defence • Hone
Royal Australian Navy Hydrographics Office • Australian Industrial Registry • Gang-Nail Au

ETS THEY HAVEN'T BEEN SWIPED

How HARDCAT can work for you.

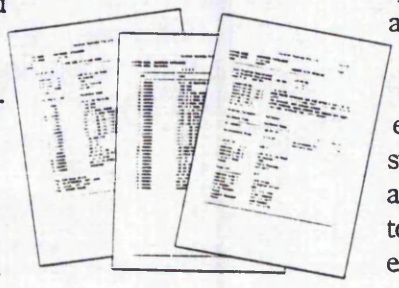
HARDCAT works on any IBM compatible MS-DOS PC. It uploads information directly, and lets you download data into flat files for use in programs such as Lotus, Dbase etc.

HARDCAT has great user flexibility. It can



interface to other existing systems and provide information for a variety of uses. Information can also be transferred to HARDCAT directly from another system.

HARDCAT has simplified assets management for over 100 Australian companies, including Kraft Foods Ltd, ANZ Treasury Department, Australia Post and the Australian Stock Exchange, and it can do the same for your company.



Hardcat prints out the level of information required from page by page reports to complete catalogues.

Any Questions?

Q: Can I upgrade my existing system to HARDCAT?

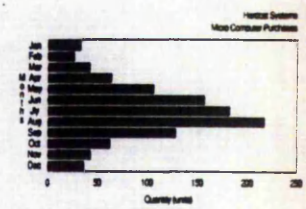
A: Yes, HARDCAT's inbuilt conversion routines will read your existing files and it will generate itself without re-keying.

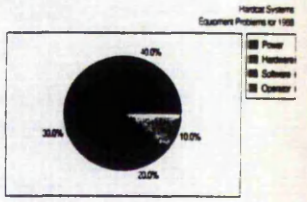
Q: How do I produce barcodes?

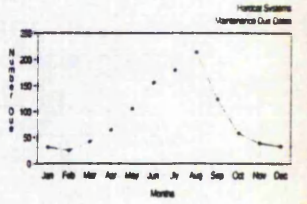
A: With your own laser printer, or we can organise an inexpensive and high quality supply of labels bearing your own distinctive logo or markings.

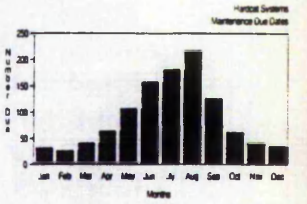
Q: What about set-up and training?

A: HARDCAT is so simple to set-up you can do it yourself. Or use our help. We offer hot-line assistance for queries and questions, and provide full on-site training. Integrated, on-line help screens at every level in the system provide appropriate assistance to newcomer and experienced user alike.









On screen graphics

AUSTRALIA INCLUDE

ıd Bank • Australian Stock Exchange • Auditor Generals Office • Victorian Dairy Industry Authority • Commonwealth Bank Finance Company • Coopers & Lybrand • Country Fire Authority • Carlton United Brewery • Australian Eagle Insurance • Ministry of Education • Electricity Board using & Construction • Ministry of Housing & Construction • Paxus Group Pty. Ltd. • Information Services Australia • Kraft Foods Limited y • Melbourne & Metropolitan Board of Works • Melbourne Transit Authority • National Australia Bank • Ord Minnett Limited (Australia & London) ority • Royal Life Insurance Australia Limited • South Pacific Tyres • State Bank • Transport Accident Commission • Telecom Australia (Vic. & NSW) V-Line • Bond University • Westpac Banking Corporation of New York • Rural Water Commission of Victoria • Ipec Transport Group vell Limited Australia • Toyota Motor Sales • Telecom Australia–Client Services • ACC Holdings Limited (National Mutual) • Alcoa Australia Pty Ltd ralia Limited • Du Pont (Australia) Limited • Australian National Line • Department of Forestry •

HARDCAT Rev. 3 OVERVIEW

Benefits

1. Keeps track of all computer hardware & software.
2. Monitors hardware problems.
3. Automatic hardware audit via barcoding.
4. Depreciation calculations.
5. Maintenance control.
6. Component breakdown (ie bill of materials).
7. Keeps track of all Suppliers & Locations.
8. Complete control of all Hardware/Software financial details.
9. Machine performance statistics.
10. Diagrammatic representation of hardware & components.
11. Graphics, charts, bar and pie graphs etc.

Features

1. User specified questioning of Hardware/Suppliers/Locations/Problems.
2. Direct access via Barcode and/or serial number.
3. Enquiry facilities at all levels.
4. Multiple password protection.
5. Highlights outstanding problems.
6. Built-in interactive help facilities.
7. Text editor which allows user to load ASCII text files directly into HARDCAT.
8. Ability to load HARDCAT directly from an existing asset system.
9. Download facility allowing user to port HARDCAT into Lotus Dbase etc.
10. Equipment movement history; HARDCAT tells you where a piece of equipment is NOW as well as where it has previously been.
11. Sorting facilities allowing user to specify the order of reports.
12. User specified report generator.
13. Indexing & cross referencing at all levels.

Running Requirements

Memory	640K
Hard Disk	10 meg
Operating System	MS-DOS
Machine	IBM XT/AT OR COMPATIBLE
System Developers	Hardcat Systems (Melbourne)
Maximum File Sizes	None

Your Local HARDCAT Dealer is:

HARDCAT SYSTEMS (UK) LTD
THE BOTHY
ALBURY PARK
ALBURY
GUILDFORD
SURREY GU5 9BH
TEL : (048641) 3886
FAX : (048641) 3669

HARDCAT IS

Unit 10, Albert Square
Cnr Albert and Queens Roads
Melbourne, Vic. 3004.
Telephone: (03) 820 2884
Fax: (03) 820 2886

PROJECT PLAN

"In business, systems analysis and design refers to the process of examining a business situation with the intent of improving it through better procedures and methods.

Systems design is the process of planning a new business system or one to replace or complement an existing system. But before this planning can be done we must thoroughly understand the old system and determine how computer can best be used (if at all) to make its operations more effective. Systems analysis is the process of gathering and interpreting facts, diagnosing problems, and using the information to recommend improvements to the system." (defn' G.1)

As a result a number of methodologies exist for systems analysis and design such as,

(i) Systems Development Life Cycle (SDLC) Methodology
(ii) Structured Systems Analysis Development Methodology (SSADM)
(iii) Systems Prototype Methodology

The aims of these methodologies are all much the same, that is to provide systems analysts a standard method for developing new systems efficiently and correctly that meet the users needs whilst keeping costs to a minimum. These methodologies are in widespread use and each is effective when properly used. They describe the set of activities that the systems analyst must carry out to develop and implement an information system. Proper use of the tools associated with these methodologies can improve the effectiveness and efficiency with which the systems analyst develops an information system and benefiting the overall quality of the system developed.

This project requires an analysis of the current system used, focusing on the administration and technical support functions within the Computer Services Department of Brush Electrical Machines Limited. This is required to establish and document a clear and concise understanding of how the system works, within the scope of this project, in terms of the working practices and functionality of procedures used; current problems; current needs; and the short and long term requirements.
Of the above methodologies SDLC will best describe the activities carried out during the development of this project. However, a number of features best associated with other methodologies will also be used and together will form the project plan as outlined below.

Of particular use to the author was a diary dedicated to the planning and scheduling of project activities so that a record of tasks performed could be kept; when and where planned meetings are to be held; information gathered on an ad-hoc basis can be jotted down as a reminder for further investigation; and as an overall checklist of jobs to do and their deadlines.

SYSTEM LIFE CYCLE PROJECT PLAN

The project activities of this report will take the following form:-

1. Statement of Project Request
   a. Statement of problem
   b. Source/reason for project request
   c. Statement of solution
   d. How will this system help

2. Preliminary Investigation

   a. Clarification of the needs
   b. Determine size & scope of project
   c. Statement of the company strategy
   d. Statement of the company policy
   e. List/overview of requirements
   f. Possible approaches/solutions
   g. Feasibility study
   h. Estimate of cost & benefits
   i. Conclusions

3. Full Investigation

   a. Establish current working practices
   b. Determine current/foreseeable problems
   c. Determine current/future requirements
   d. Establish current quality of product
   e. Establish required quality of product

4. Analysis

   a. Examine each major problem area
   b. Examine each major procedure used
   c. Examine requirements

5. Design

   a. Detailed discussion on possible solutions
   b. Description of selected solution
   c. Cost & benefits of proposed solution

6. Implementation

   a. Design of all hardware and software systems
   b. Implementation of hardware and software
   c. Implementation of standards
   d. Implementation of documentation

BREAK DOWN OF ACTIVITIES

1. Statement of Project Request

   a. Statement of problem

      This describes the problems, their significance, frequency, users viewpoint.

   b. Source/reason for project request

      This determines the reasons for starting the project. To clarify what is being done, and why?

2. Preliminary Investigation

   b. Determine size & scope of project

      This describes the project scope in terms of People, Time, and Money.

   e. List/overview of requirements

      For each area an examination of the needs of the people and features etc.

   g. Feasibility study

      This examines the Technical, Operational and Financial feasibility of the proposed solution (in general terms). Any proposed system must be feasible in all three areas.

      Technical Feasibility clarifies hardware & software requirements in general terms and whether it exists or can be acquired along with a statement of response times,accuracy, ease of access,reliability, level of flexibility and compatibility of this hardware & software.

      Operational feasibility clarifies the level of management support for the project; user support; resistance to change; and problems caused by the proposed system. Financial Feasibility discusses cost of developing the system, the cost of not doing anything at all, and contrasting with benefits expected.

   h. Estimate of cost & benefits

      Costs always come before benefits. This will be in terms of improved information; Better controls; and Saving time.

   i. Conclusions

      This will include a statement on the reasons for continuing the project investigation (or not) to justify additional investment into the project.

      The full investigation covers many of the items already studied but in more detail and examines each problem area in detail, how it currently works, what forms are used, what flow of information exists or is required; the volume of data through the system and where it originates.

Items 1 to 6 above, form modules that will be associated with one or more of the following chapters as described by the 'Final Year Project Guide':-

Chapter 1: Introduction

Chapter 2: Limitations of Existing System

Chapter 3: Design of New System

Chapter 4: Design and Development

Chapter 5: Implementation and Results

Chapter 6: Discussion and Conclusions

Appendices

Acknowledgements

NETWORKING AND THE AUTOMATED OFFICE

As with most progressive companies such as BEM the automated office is becoming a reality very quickly. Since the introduction of micro-computer systems software systems have been widely available at a relatively low cost and as such have been adopted by businesses looking for a low cost solution to improving slow, error prone paper based systems.
The facilities required of an automated office are:

wordprocessing,
spreadsheet,
databases,
personal filing,
and diary systems.

company file access,
information services,
Email,
memos,

This thrust to handle paper more efficiently is responsible for the evolution of the automated office which started with just stand-alone PC's running wordprocessing, spreadsheet and databases under MSDOS. The second stage consists of creating communication links between minis and mainframes and using these PC's as terminal emulators to extend company file access in addition to the existing VDU's. This stage allows EMail to be possible.

The latter stages of this evolution include full networking of all PC's, minis and mainframes (or centralised computer systems), running different operating systems other than MSDOS such as OS/2 or UNIX.

The important point is that all this has been made possible through the use of communication networks. This leads on to the new approach being adopted by industries and businesses alike which is distributed processing. This is the off-loading from the once centralised dedicated system to separate local processing systems.

THE CURRENT HARDWARE & SOFTWARE CONFIGURATION

The following description, starting with the overall computer environment, gives an overview of the computer resources available to meet the business needs and again highlight the complexity of this investigation.

There are 2 main air conditioned computer rooms with false floors and ceilings protected with a brand new fire-cat early warning fire & smoke system which triggers off the release of 4 Halon gas cylinders in 'room 2' and 6 cylinders in the 'main room'. The rooms are connected by a short tunnel with 2 doors designed to withstand 2 hours of burning. There is a third air-conditioned room for all the main line & band printers used by the systems.

The Data General (DG) computers used are named HOSTA, HOSTB ... upto HOSTH they are listed below:

HOSTA is a D.G C350 with 2Mb memory, two 50Mb disk drives (exchangeable disks), 80Mb fixed system disk, mag. tape deck, running AOS operating system with 32 user terminals connected of which 6 are port selector (P/S) VDUs (to enable connection to any of the other DG systems). The printers available are 2 daisy wheel Qume 5/45, 2 daisy wheel Qume 9/45 and 4 draft printers D.G Tp1's and Tp2's and an Epson RX80. Also a paper tape punch in the Telex dept. This machine is used mainly for word-processing (CEO).

(N.B. HOSTA has just recently been decommissioned, and essentially replaced with a PC network of wordprocessor systems.)

HOSTB is a DG MV8000 with 7Mb of memory, 2 exchangeable 277Mb Vulcan disk drives , mag. tape deck and is running AOS/VS (Advanced Operating System/Virtual Storage) with 32 VDU's connected of which 5 have Port-Selector facilities, 3 Tektronic plotters, 1 Hewlett-packard 7550A plotter, 2 G300 graphics VDU's, 3 screen dump Facit 4513 printers, 1 Facit 4542 400cps printer, and several other small printers such as an Epson FX-100. This machine is used mainly by the Engineering & Design depts.

HOSTC is another C350 with 1 Zebra 50Mb (exchangeable) disk drive & 1 Kismit system disk 80Mb. This runs AOS with 22 user connections of which 2 have P/S facilities. Peripherals are: 1 H.P plotter; 1 SRP750 paper tape punch (PTP); 1 Facit PTP/tool presetter; 1 M42 PTP; 2 Epson FX-100 printers and a BMC80 DIGITAL NC Machine Tool connected to the system via a Broadband network made up of a fibre optic link using ITL Cablestream 2532 Modular Packet Communication Unit; ITL 2550 Network translator and an ITL frequency translator linked at the computer end and Packet Communication Units (PCU's) at the peripheral end which includes a printer,PTP,tool reseter and of course the N/C machine tool as already mentioned above. The programs & data needed by the NC machine are downloaded from the HOSTC system when required and then the NC machine works independently of HOSTC. The main users of HOSTC are NC programmers.

(N.B. HOSTC has been decommissioned and replaced with a SUN 3/260 UNIX file server).

HOSTD is a DG MV10000 with 18Mb of memory, 1 fixed winchester disk (ARGUS disk) of 354Mb, and 3 Vulcan 277Mb disk drives, 1 mag. tape deck and is running AOS/VS with 80 VDU lines of which 4 are P/S; 8 draft printers and 1 lazer printer are connected. This machine is used mainly for the Commercial Dept., word-processing, contract systems, Data prep and Purchasing Departments.

HOSTE is a DG MV8000 with 9Mb of main memory, 1 tape deck, 3 Vulcan 277Mb disk drives and is running AOS/VS operating system with 32 VDU's connected. Also connected is 1 Qume 5/45 daisy wheel printer and 1 Facit 4542 draft printer.

This machine is used by the programming department developing Cobol programs and testing new packages such as 4GL's and expert systems.

HOSTF is a DG MV4000 with 7Mb of memory, 1 tape deck, 1 Vulcan 277Mb hard disk drive and is running AOS/VS with 8 VDU lines attached. This machine is for testing a distributed computer network and has attached to it via an ITL cablestream chipcom Ethermodem 2 new Desk Top Publishing systems (DTP) used in the sales & design departments. The Ethernet network is being tested by using HOSTF as a routing device for HOST's A,B,C,D,E to be networked to HOSTG.

HOSTG is DG's largest computer an MV15000 model 20 with dual processor capability. This has 32Mb of memory with 3 fixed disk units each 592Mb capacity and 3 fixed disk drives each 354Mb plus a Vulcan 277Mb exchangeable disk drive. Also 2 high speed horizontal tape decks. HOSTG runs on AOS/VS rev 7.57 with 161 VDU's connected of which 6 are P/S. 7 Facit 4514 high speed draft printers; 4 Facit 4542 high speed printers; 5 Epson printers; 2 Brother HR15 printers for the microfiche systems; 12 Facit & Epson screen dump printers and 3 modem connections are attached to this machine. The modems CASE DCX 815 are used for various things including the connection of 6 VDU's and several printers on another Brush site a couple of miles away. HOSTG is used for the Purchasing, Accounts, Production, Goods Received, Purchase Invoice Checking, Reprographic, and several other departments.

There are many different types of VDU used which include D2, D200, EMULOG 200, TATUNG, SCS200, VISA-LINK 125 and D216 all of which emulate DG D200 data flow using EIA RS232 and current loop 20ma serial connections for all the VDU's and printers. Current loop is used for longer distances across the Brush site and 20ma line drivers are used where interference is a problem. (Especially when vdu lines run along side 100 KVA power lines supplying heavy electrical switching machinery).

The Port Selector is the same as the one at Trent Polytechnic which is a CASE DCX 850 electronic packet switching device costing approx. #100,000. This enables a number of strategically placed VDU's to be able to log on and use any of the DG computers which are independent of each other but for the network bus which runs along them. The internal network which allows data files & records to be transferred from one machine to another is a DG NBS network. This requires that each computer is running DG XODIAC X25 network software.

The DTP system comprises of the state-of-the-art hardware & software. Two DG 286 desk top computers with approx. 5Mb of memory each running MS-DOS, GEM, PUBLISHER PAINTBRUSH, CEO DESKTOP COMPOSER, CEO-WRITE WORD-PROCESSOR, MS-NET SERVER, MS-NET PCI, SPOT (OCR), VENTURER and other software packages and has connected to it a LPB 800 model 2 lazer printer and a digital scanner, large
high res. monitor and an optical mouse. The network software allows the DTP
system to use the main DG computers & their storage as a main file server to the DTP system. BEM has the largest Data General installation in the country.

The Software used on the DG Systems:

The application programs used on HOST's A,D & E include Comprehensive Electronic Office system (CEO) a word processing package.

On HOST's B & E FORTRAN 5 & 77 are used to develop technical systems and also the most used COBOL. On HOSTC MDSI Compact II package is used for preparing
tapes for NC programming. All the HOST's use a data base system called INFOS_II and the JCL that run on the DG systems is called Command Line Interpreter (CLI).

Nearly all the application programs used by the users are written in-house.

The ICL Systems:

The ICL 2955 3.5Mb of memory and 800Mb of disk running George 3 operating system with 13 user VDU's connected. The payroll system which used to run on this system has been converted to VME Unipay/Personnel Integrated TP package.
Languages used is Cobol, NCC Filetab, MGB Purchase Ledger package.
This machine is now mainly used for other financial systems but after
the software conversion is complete all the systems will be transferred to the
DG and ICL 3925 systems.

The ICL 3925 has 12Mb of memory and 1800Mb of disk storage and runs VME operating system with 8 VDU's connected. This system is used for running the Payroll system only!
Networks on this is an OSLAN (Office Systems LAN). A SAM system is set up for remote off-site maintenance of the ICL computers.

Additional Hardware:

As well as the large 1500 lines per minute printers attached to both computer systems there are various pieces of equipment such as Decollators, Bursters, Guillotine, shredders and a UNIVAC Punch card verifier.

A Un-interruptible Power Supply system (UPS) with 5 minute of battery backup and a diesel generator which can run for 8 hours has recently been installed (OCT-88) which can provide 100 Kva in less than 30 seconds.

BEM COMPUTER SERVICES EVOLUTION

The Computer Services Department consists of 2 main sections, the Operations & Resources section and the Applications dept. The following page is the reporting structure within the department as it was in Oct-87 formulated by the then new Computer Services Manager who started several months earlier.

Previous to this structure the computer department had no direction or structure to speak of what so ever. Only that the current systems & user support was merely maintained without any significant steps forward in improving existing systems or developing new ones. The only expansion that took place was on the basis of if a user needed access to a particular system we bought a VDU and set him up on it. This lack of organisation was due to a number of reasons such as higher management not backing new plans with enough commitment. This may have been to the way the plans were presented and organised. Another contributory factor to the problems was that the department did not have a departmental head for approx. a year due to his nervous breakdown. Hence the department was being jointly run by the heads of the Resources & Applications department.

The new manager locked himself away when he started for several months sorting out the departments and one of many startling facts he discovered which highlights the problems of the lack of planning was that of the payroll system running on the ICL 2955. The company was told that by the end of February the current payroll system would be out of date and that it would be illegal to use. This ultimatum was given with about 12 months notice but no one had acted on it until it was very nearly to late. A large conversion program started which involved buying a new ICL 3925 computer which would be capable of running the proposed payroll system. The installation of this computer went surprisingly smoothly. At the same time BEM attempted to recruit extra programmers in order to meet the deadline in converting the systems in time. There were 4 ICL programmers familiar to the systems with an estimated 100 man weeks of work to do in 25 actual weeks left. The computer department was forced to contract out approx. 12 programmers from various agencies at a great expense. A lot of money could have been saved if the payroll problem had been better anticipated & planned However there was no option other than hiring #30/hour programmers who worked 7 days a week and some 30 hours a day for several months. This required a high degree of reliability and availability from the computer systems and the department as a whole. The current state of this evolution is described in chapter #1 under the heading of Project Request.

HELP DESK

This term is given to a group of people who, depending on the company, have varying levels of computer expertise. This setup is not dis-similar to Information Centres which were originally developed by IBM. Their function was to provide an independent service to users offering advice on all aspects of computing such as software & hardware selection. Information centres have access to most software for evaluation in order that they can advise others of its usefulness. Information Centres would help and thus allow users to develop their own applications which it self has considerable advantages.

Help desks are dedicated to assisting the users with any problems that may arise. Any problem that can not be dealt with by the Help Desk will be fielded (passed on) by the help desk to people who can deal with the problem. Thus, providing a single point of contact for the users and a guarantee that there will be always someone available to deal with the original enquiry.

EXPERT SYSTEMS

There are many definitions of Expert Systems which reflect the purpose of a specific system or the differing users perceptions of such systems. However, the following British Computer Society (BCS) definition possibly reflects best the recent developments in expert systems.

> "An Expert System is the embodiment within a computer of a knowledged based component, from an expert skill, in the form that the system can offer intelligent advice or take an intelligent decision about a processing function. A desirable additional characteristic, which many would consider fundamental is the capacity of the system on demand to justify its own line of reasoning in a manner directly intelligible to the enquirer. The style adopted to attain these characteristics is rule based programming."

NETWORK SUPPORT

As office automation increases so does the communications networks and with it the management and support of the network.

There are many aspects of network management which if not coordinated and planned correctly can lead to very expensive mistakes. Network support includes the areas of implementation, maintenance, expansion, and administration. Their implementation is a costly exercise in terms of the cabling and installation and varies greatly with the different types employed. For example, broadband cable is very expensive and so too is the 'tuning' required during its installation. Broadband at BEM comprises of coaxial cable shielded against 120db of noise. A radio frequency (RF) signal is used to encode data onto it. These frequencies must be of a precise degree at every point in the network, thus the importance of tuning. Devices required to prevent the RF to attenuate below a certain level are required at pre-determined distances along its cable. Thus, the importance of locating the cable and its components accurately.

The expansion of networks is important when new services are required by a particular department that will utilise communication links. If any links already exist nearby it may be possible to make use of them. However, as well as being able to locate these links the current & forecasted load on these links will need to be considered as will other new developments in the area in question.

The administration of networks is important particularly if connection outside the company is required, in terms of standardising on network addresses and protocols.

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- How to Write an Agent

Part# 800-3468-10 SUN

(20) SunNet Manager

Installation and Users Guide

Part# 800-3481-10 SUN

THE USER

There are many types of users with varying levels of skill & intelligence which use the computer systems. This measure of ability however is not what determines the compatibility between the user and the computer and its peripherals. It is usually one of two things. The lack of confidence and lack of training on new systems.

There are 3 main categories of users. The shop floor type, probably the foreman, the office user and the senior management.

Shop floor workers use some DG systems for entering work in progress, stock level and goods delivered information, to name but a few. This type of user learns to use the systems in a parrot fashion way. He thinks of his VDU as his own computer not realising that its connected to something other than the mains supply. When one these users rings up with either a hardware or software fault the following information is required: which computer he is connected too; the console number; and the name of the application program he is running in order to solve the problem over the phone. More often than not he will not know any of these details. In this eventuality Technical Support staff will have to go and find the VDU, which could be upto 10 minutes walk away, only to find that its not plugged in correctly or to press 1 button to unfreeze the screen.

The greatest number of users are the office staff such as accountants, engineers, draughtsman or secretaries, etc. Depending on the age or whether or not they have been introduced to computers at an earlier stage effects their use of the computer systems. This is because they have little confidence in their use; or think that computers are a waste of time & effort or the user thinks he knows all about it when in fact he knows nothing. This can make for very inefficient use of the system. Users ignorance of computers, through no fault of their own, has in the past been under-estimated and caused a lot of problems in the installation of new systems such as the computerised Purchase Invoice Checking system. The users for many years dealt with a great deal of manual paper work and were set in their ways. The training programme BEM performed in-house to show them how to use the system lasted twice as long as originally anticipated and the analyst responsible for the system had to spend several weeks 'holding their hand' whilst they got used to it.
To help with this type of problem the computer department encourages users to buy home/personnel computers, by offering an attractive purchasing scheme through the company, in a hope that this will improve the computer literacy of the user. Other training programmes are available making good use of video based training products.

The third less prolific user is that of the senior members of staff such as department heads who use production and stock and financial systems for on screen enquiries.

THE USERS VIEW OF THE COMPUTER SYSTEM

Since Computer Services' main product is to provide a service to the users the department first has to know what the users want. Thus, the following discussion has been compiled as a result of the questionnaire guided interviews conducted by the author to gain an insight into these user needs.

There are many departments and offices within BEM most of which are computerised to some extent. Whether its a PC sitting on some ones desk for word-processing or other systems which that department has produced themselves or its a VDU connected to the DG mainframes again for word-processing or other major systems such as the STOCK CONTROL system, PURCHASING, MICROFILM, PROCESS & PIECEWORK TICKET PRODUCTION, PROGRESS, BILL OF MATERIALS & TECHNICAL COSTING, CONTRACT SCHEDULE, PLANT REGISTER, TENDERING, and GOODS IN SYSTEMS all of which are on-line with real-time update of files and databases. Quite a lot of batch work is also run overnight for updating some other systems databases and for generating reports which are either printed on the main line printers in computer resources or automatically printed on the printers in the relevant departments.

Hence, there are many points of contact between the computer department and the user. Each of these points of contact are open to both praise and criticism and has to be conducted very carefully due to the political nature of Computer Services position.

The following are the major areas of contact and what the author interprets to be the users view of it. (The author would like to point out that it would be both difficult & time consuming to ask every user department in turn as to their opinion of the Computer Services therefore some opinions are based on what the author heres and picks up when he visits or rings user departments. One of the major problems in conducting this type of interview is attempting to contact key people about their view of the computer but they are to busy and will ring back later which often they do not. Some may find this attitude surprising when there are times when the user is more than happy to express their opinion when things are going wrong).

The users main areas of concern are with ...

i) The availability of the computer systems

ii) The response times on the VDU

iii) The ease of use of the VDU systems

iv) The usefulness of the system

v) The accuracy and reliability of the software

vi) The operation and reliability of any peripherals such as printers and VDUs

vii) The maintenance response for any of the hardware.

viii) The response to software problems

ix) The response & advice to user queries, such as how to use a particular piece of hardware or software to what the best PC to buy is!

x) The success/failure of overnight batch work determines whether they have any reports the following morning.

xi) The collection of printouts

xii) The collection of paper and other consumables for peripherals.

xiii) The response to requests for modifications or installation of systems.

(N.B. The word 'system' in the above list implies hardware & software as seen by the user).

In the above the users get very upset if the response, reliability,availability
or other criteria are not of a higher enough standard.

It is in the authors opinion the users are fairly happy about points iii), iv), v), and xi) but they may not be too happy with the response in points viii) and xiii) because of the shortage of Computer resources staff. Point x) is on average very reliable but if a job fails to run the user forgets that the success rate is approx. 99% and complains bitterly.

INFORMATION TECHNOLOGY (IT)

Business Information Systems

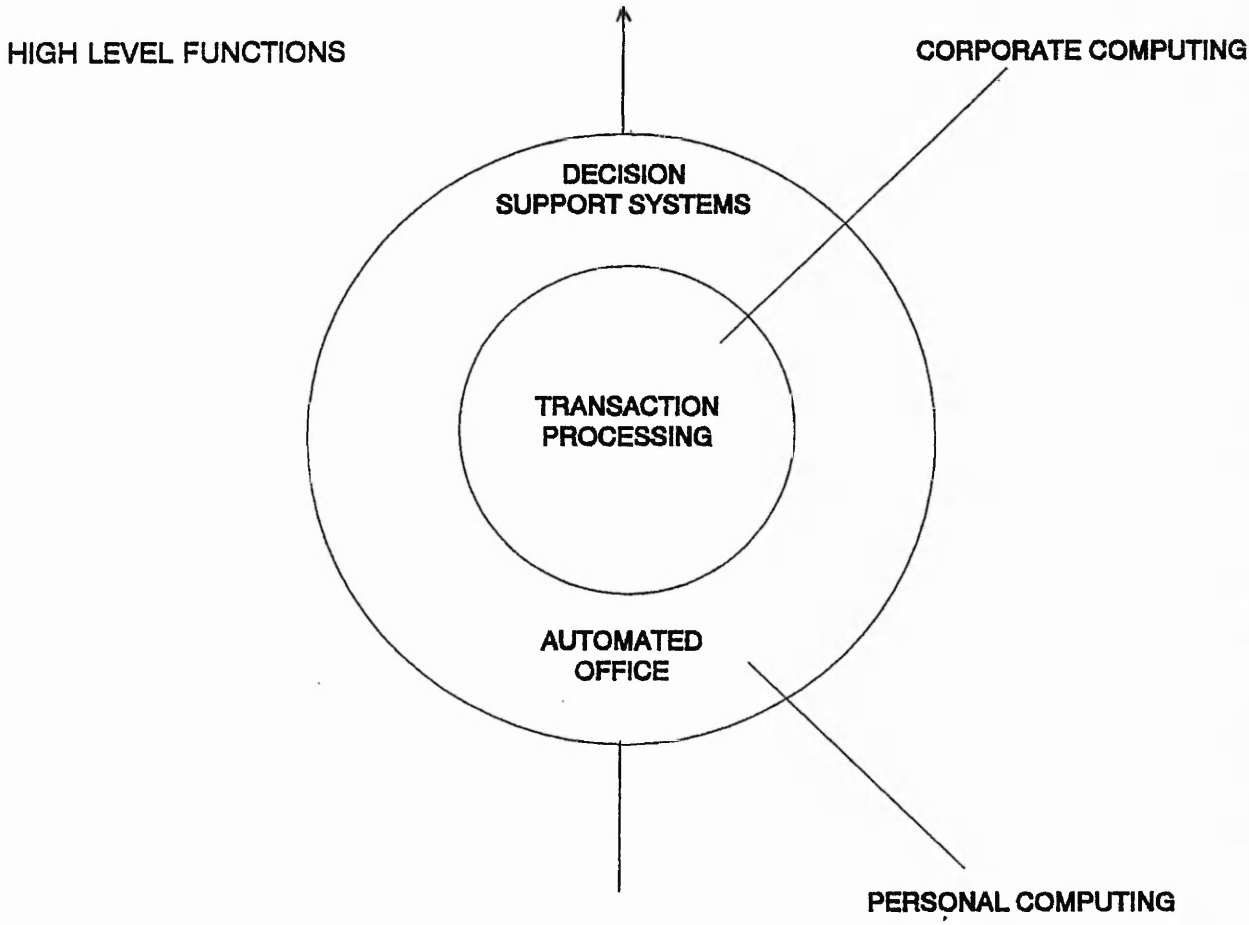
Business problems are often connected with the lack of and need for the information necessary to control the organisations activities. The need for information and the consequent requirement for a means of processing raw data rapidly and accurately applies to an ever increasing range of work areas in business. All this means that control is necessary to manage all of the data in order that it may be processed efficiently.

Through the ongoing advances in computer & communications technology the features and development of information systems has evolved. This development of information systems has been the major force on the evolution of the information economy. Hence today society relies on information systems technology whose application is increasingly widespread.

To facilitate the efficient operation in a business and cope with the ever increasing volume of data and information flowing through a company a computer & information system will always occupy a special place in a business in order to remain competitive with other organisations.

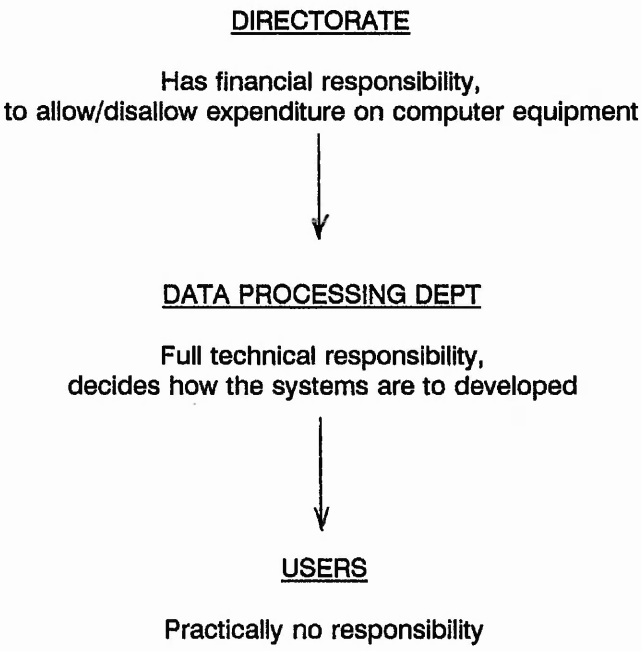
The strategic use of information will gain a competitive advantage via new products & services or dealing more effectively with the environment of the business (suppliers & customers), and this will determine which firms will succeed/not.

Business information systems can be modeled on the following diagram:



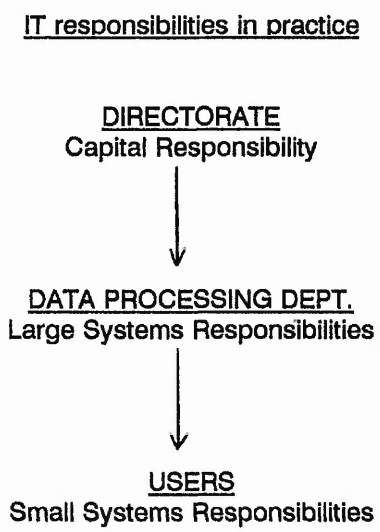
Traditional IT responsibilities

The traditional IT responsibilities are best described with a diagram:



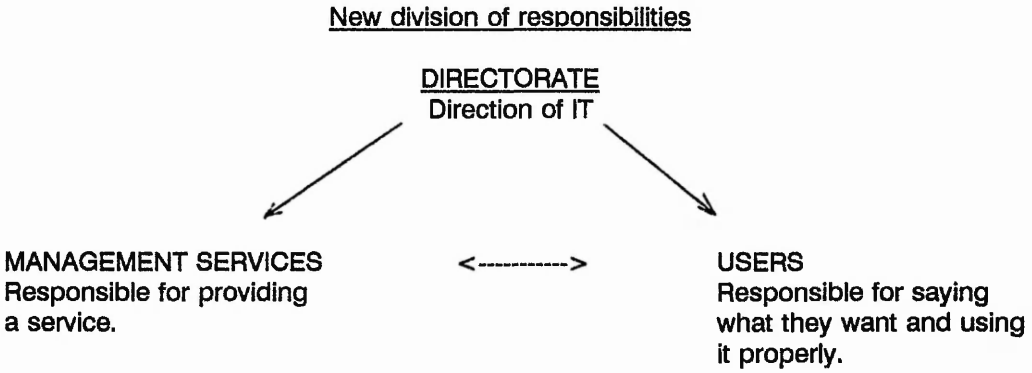
The result of this structure was a form of regimentation. A number of serious disadvantages occur if a user is not involved as an early stage with the development of a new system. Firstly, there is likely to be more resistance to change on the claims that the new system does do what the user wants or asked for; the users are stuck in their ways and simply do not want to change; and more importantly the new system does not meet the business users needs.

As a result of the above, the following diagram indicates IT responsibilities in practice at the less progressive companies:



The result of this structure, which has largely been made possible since the introduction of high performance cheap micros, is **anarchy**. The Users get tied of waiting for the promised new system and take it upon themselves to develop their own systems. Data Processing department (DPD) are aware that this happening but because of their heavy work load find it difficult to develop systems by the time users want them. However, the DPD reassure themselves by saying that they know what they are doing, they are the experts, and that the 'Users' do not. As a result there is little/no coordination between these two areas. The directorate take no interest in the computer systems development except for how much it was going to cost.

The more progressive companies can see these problems (or learn by their mistakes) and form a new division of responsibilities as follows:



The result of this structure is a **partnership**. Here the users specify their own small systems which itself takes a load of management services. The management services help the users as much as possible, giving advice etc. The directorate must be more aware of IT in general and support it.

A policy and strategy are needed to ensure that the allocated resources are used to best advantage. The policy is the highest level statement of how the organisation will handle computers. The strategy is the highest level statement of how the policy will be implemented. Without these the IT partnership cannot work.

The New Approach and Attitude Towards Computers

In December 1987 the proposed computer strategy and 5 year plan was agreed in principle by the Board of Directors and work started on the scheduled projects. This involved the installation of another DG computer and the upgrading of Computer Resources facilities in order to increase the response, reliability and services provided to the users.

A meeting between the senior members of the Computer Department highlighted the successes, failures and future plans for computing at the Brush. Some of the main points follow:

Firstly they all agreed that the definition and implementation of a long term computing strategy has given better focus & direction.

The improved visibility of the role of Computer Services helps communication between the users and staff.

Management commitment through the newly setup Steering Committee and management Groups has improved greatly.

Unfortunately there is still a significant proportion of middle & senior management remain uncommitted to increased computerisation. Courses for this level of staff have been proposed.
A 'help desk' is to be setup to help improve the service to the users as well as improving the efficiency with which we work.

Other sources of manpower will be considered for certain projects. This manpower could come in the form of students on thick sandwich Computer Science/I.T. Courses; self employed programmers working from home and internal recruitment.

The awareness programme mentioned earlier will cover:-

- What is a computer?
- Application of Computer Technology
- Strategic Implications of Computer Technology
- Workshops on establishing business and hence computing requirements
- Improved publicity on what is happening, direction etc.

The improvement of quality, accuracy and responsiveness of our interfaces to both customers and vendors, and where possible, to become more closely integrated with their systems is a major requirement which is being investigated. This approach will hopefully improve not only the internal systems but improve the interfaces and image with external entities and thus add value to their design/order process and thus enhances the use of BEM as a supplier in the future.
The long term plan includes the implementation of a distributed approach to computing which requires us to move to a relational database environment, which will be an integrated part of the 4GL environment. The use of both 4GL and relational database technology will incur hardware performance penalties and require a top-down approach to system design, but can reduce timescales in the development phase by a factor of 3, maintenance by a factor of 10 and report generation by a factor of 10 as well as significantly improving documentation and functionality.

SYSTEMS DEVELOPMENTS IN THE 1980'S

Over the last ten years systems were developed from requests received from, or in discussions with, departmental heads. Systems developments were often driven and specified by Computer Services with little involvement from the user departments. This has resulted in systems specific to those individual areas eg, Purchasing, Production Control, Commercial, Drawing Offices, Process etc. Within these disciplines a fair degree of integration exists, but very little across the disciplines and the information produced was to support the day to day operational tasks of the business and not the decision support requirements of the managers.

Information was entered into the Computer Systems by:-

(a) sending hand written forms to Computer Services for punching by the Data Preparation Section and subsequent batch processing by the computer.

(b) typing into VDU's / non intelligent terminals connected to a mainframe type computer.

In both of the above situations the information was stored and processed centrally. If the computer was 'down' for any reason then the users connected to that machine were unable to work. This centralised approach is shown below in Figure K.1.

CENTRALISED COMPUTING

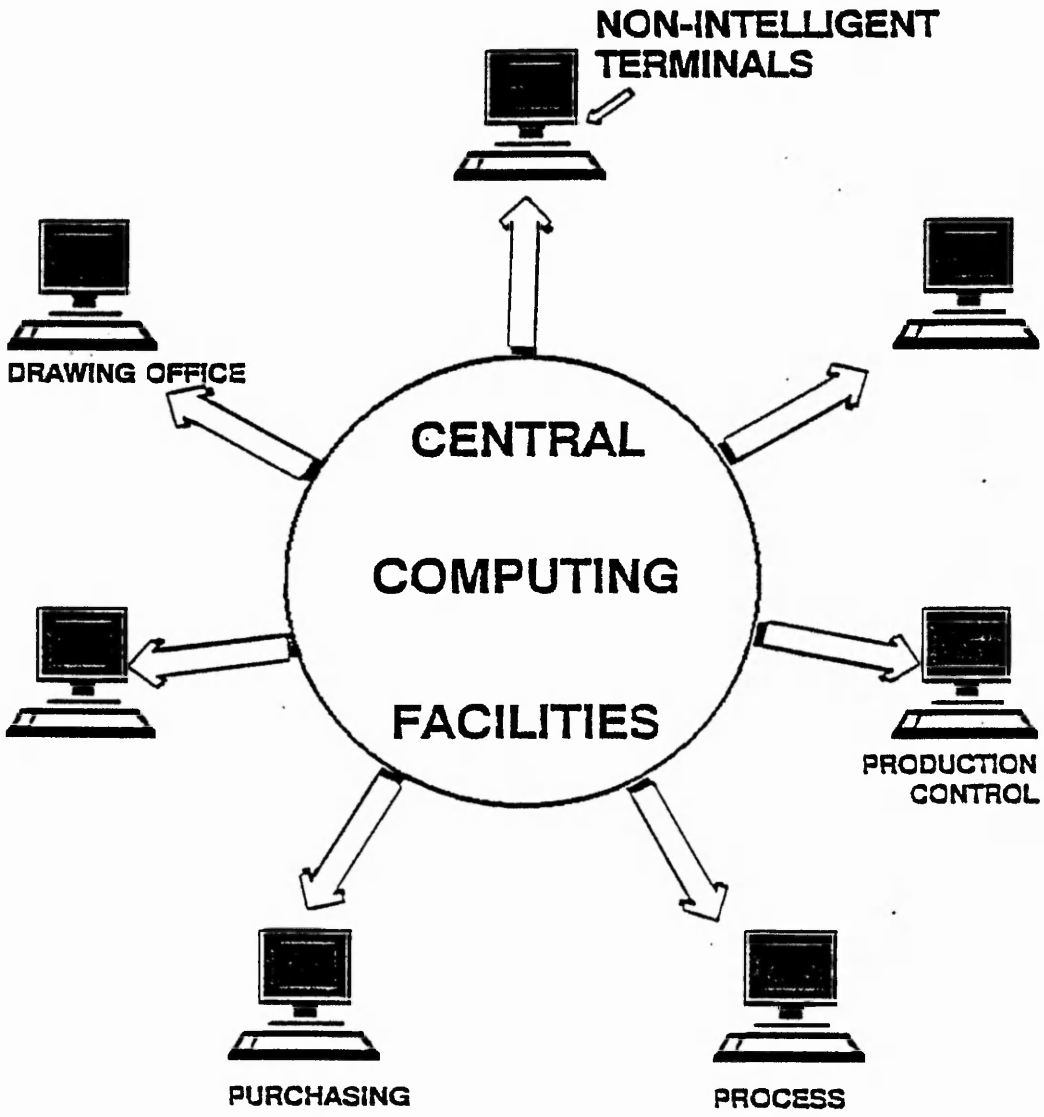


Figure K.1 (Taken from "Business Computing at BEM")

Centralised Computing

ORIGINAL COMPUTING STRATEGY AND FIVE YEAR PLAN

In December 1987 the proposed computer strategy and 5 year plan was agreed in principle by the Board of Directors and work started on the scheduled projects. This involved the installation of another DG computer and the upgrading of Computer Resources facilities in order to increase the response, reliability and services provided to the users.

A meeting between the senior members of the Computer Department highlighted the successes, failures and future plans for computing at the Brush. Some of the main points follow:

- Firstly they all agreed that the definition and implementation of a long term computing strategy has given better focus & direction.

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- Management commitment through the newly setup Steering Committee and management Groups has improved greatly.

- Unfortunately there is still a significant proportion of middle & senior management remain uncommitted to increased computerisation. Courses for this level of staff have been proposed.

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- What is a computer?
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The improvement of quality, accuracy and responsiveness of our interfaces to both customers and vendors, and where possible, to become more closely integrated with their systems, is a major requirement which is being investigated. This approach will hopefully improve not only the internal systems but improve the interfaces and image with external entities and thus add value to their design/order process and thus enhances the use of BEM as a supplier in the future.
The long term plan includes the implementation of a distributed approach to computing which requires us to move to a relational database environment, which will be an integrated part of the 4GL environment. The use of both 4GL and relational database technology will incur hardware performance penalties and require a top-down approach to system design, but can reduce timescales in the development phase by a factor of 3, maintenance by a factor of 10 and report generation by a factor of 10 as well as significantly improving documentation and functionality.

Specific Computing Strategies

- Secure, supportable, dependable systems
- Improve input control / accuracy
- Improve scheduling of work and materials
- Provide feedback on progress / cost / utilisation
- Improve financial reporting accuracy and timeliness
- Increase administration efficiency
- Integrate systems

APPENDIX M

The contents of this wallet are sample forms used for reporting faults with hardware and software.

- Maintenance Report Sheet
- ICL Maintenance Report Sheet
- Data General Maintenance Report Sheet
- Special Computer Group Form

MAINTENANCE REPORT SHEET

MAINTENANCE COMPANY

TELEPHONE

CONTRACT NUMBER

INCIDENT NUMBER

	DATE		TIME
NOW	≠	≠	≠
REPORTED	≠	≠	≠
ENGINEER ARRIVED ON SITE	≠	≠	≠

USER TELEPHONE

USER DEPARTMENT

EQUIPMENT

EQUIPMENT LOCATION

FAULT DESCRIPTION

WORK DONE

FIELD SERVICE REPORT (FSR) NUMBER

CALLER'S NAME SIGNED

MAINTAINER'S NAME SIGNED

ICL

Maintenance Report Sheet

TELEPHONE : 021 454 5411

CONTRACT NO: 139 34

ICL CALL NUMBER :_____

REPORTED DATE:___:___:___
TIME:___:___

CALLER NAME:_____

JOB DONE:_____
_____
_____

SIGNED:_____

ENGINEER
ARRIVED DATE:___:___:___
TIME:___:___
TIME SPENT:_____
NAME:_____

SIGNED:_____
JOB REMAINING:_____
_____
_____

ENGINEER
ARRIVED DATE:___:___:___
TIME:___:___
TIME SPENT:_____
NAME:_____

SIGNED:_____
JOB REMAINING:_____
_____
_____

ENGINEER
ARRIVED DATE:___:___:___
TIME:___:___
TIME SPENT:_____
NAME:_____

SIGNED:_____
JOB REMAINING:_____
_____
_____

BASE UNIT
MODEL:_____
TYPE/BAR:_____/____
SERIAL:_____

ITEM
TYPE:_____
TYPE/BAR:_____/____
SERIAL:_____

LOCATION:_____
USER:_____
TEL:_____

FAULT:_____
_____
_____

Data General

Maintenance Report Sheet

TELEPHONE : 081 569 9911

CONTRACT NO: C3315-_____

DG CALL NUMBER: EM_____

REPORTED DATE:___:___:___

TIME:___:___

KEY - HOSTG MV15000 C3315-001
- HOSTA C350 - - -002
- HOSTB MV8000 - - -003
- HOSTC C350 - - -004
- HOSTE MV8000 - - -005
- HOSTF MV4000 - - -006
- HOSTD MV10000 - - -007
- PRINTERS ALL - - -008
- WST1 CEO - - -009
- WST2 DTP - - -010
- VDU'S ALL - - -011
- HOSTH MV1500 - - -013

TYPE computer/vdu_____

MODEL:_____

LOCATION:_____

USER:_____

TEL:_____

ENGINEER

ARRIVED DATE:___:___:___

TIME:___:___

TIME SPENT:_____

NAME:_____

SIGNED:_____

JOB REMAINING:_____

_____

_____

FAULT:_____

_____

_____

_____

ENGINEER

ARRIVED DATE:___:___:___

TIME:___:___

TIME SPENT:_____

NAME:_____

SIGNED:_____

JOB REMAINING:_____

_____

_____

SPECIALIST COMPUTER GROUP

TELEPHONE: 0782 202310

OUR CALL NUMBER:_____
SCG CALL NUMBER:_____

REPORTED: DATE:___:___:___
TIME:___:___

CALLER: NAME:_____

JOBDONE SIGNED:_____

ENGINEER
ARRIVED DATE:___:___:___
TIME:___:___
TIME SPENT:_____hours
NAME:_____

SIGEND:_____
JOB REMAINING:_____
_____

ENGINEER
ARRIVED DATE:___:___:___
TIME:___:___
TIME SPENT:_____hours
NAME:_____

SIGNED:_____
JOB REMAINING:_____
_____

ENGINEER
ARRIVED DATE:___:___:___
TIME:___:___
TIME SPENT:_____hours
ENGINEER NAME:_____

SIGNED:_____
JOB REMAINING:_____
_____

1ST ITEM

EQUIPMENT:_____
SERIAL NO:_____
LOCATION:_____
USER:_____TEL:_____
FAULT:_____
_____
_____
NOW DATE:___:___:___ TIME:___:___

2ND ITEM

EQUIPMENT:_____
SERIAL NO:_____
LOCATION:_____
USER:_____TEL:_____
FAULT:_____
_____
_____
NOW DATE:___:___:___ TIME:___:___

3RD ITEM

EQUIPMENT:_____
SERIAL NO:_____
LOCATION:_____
USER:_____TEL:_____
FAULT:_____
_____
_____
NOW DATE:___:___:___ TIME:___:___

4TH ITEM

EQUIPMENT:_____
SERIAL NO:_____
LOCATION:_____
USER:_____TEL:_____
FAULT:_____
_____
NOW DATE:___:___:___ TIME:___:___

5TH ITEM

EQUIPMENT:_____
SERIAL NO:_____
LOCATION:_____
USER:_____TEL:_____
FAULT:_____

APPENDIX N

SQL STATEMENTS

The content of this wallet is a listing of the SQL*Plus Statements used to implement the Database System.

```
CREATE TABLE ANY_DEV (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
MANUF CHAR(10),
MODEL CHAR(10),
TYPE CHAR(10),
BOARDREV CHAR(5),
BOARDEMUL CHAR(10),
BUFFER CHAR(5),
SCREENMODE CHAR(10),
MODS CHAR(80),
DIV CHAR(3),
DEPT CHAR(10),
LOCATION CHAR(10),
PURCH_ORD CHAR(15))
/
CREATE TABLE ASYNC_BRD (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
MANUF CHAR(10),
MODEL CHAR(10),
START_LINE_NUM CHAR(10),
NUM_PORTS NUMBER,
PURCH_ORD CHAR(15),
DESCRIPTION CHAR(80),
CROSS CHAR(1),
HOSTSERIAL CHAR(20),
HOSTTYPEBAR CHAR(20))
CREATE TABLE AUX_DEV (
IOSERIAL CHAR(20) NOT NULL,
IOTYPEBAR CHAR(20) NOT NULL,
OSERIAL CHAR(20) NOT NULL,
OTYPEBAR CHAR(20) NOT NULL)
CREATE TABLE CARDS (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
MANUF CHAR(10),
MODEL CHAR(10),
BITSIZE NUMBER,
BOARDREV CHAR(5),
TYPE CHAR(10),
PURCH_ORD CHAR(15),
DESCRIPTION CHAR(80),
MEMORY CHAR(5),
HOSTSERIAL CHAR(20),
HOSTTYPEBAR CHAR(20))
CREATE TABLE COMMS_DEV (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
TYPE CHAR(10),
MANUF CHAR(10),
MODEL CHAR(10),
DIV CHAR(3),
DEPT CHAR(10),
LOCATION CHAR(10),
PURCH_ORD CHAR(15))

CREATE TABLE COMP_COMMS (
```

```
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
HOSTSERIAL CHAR(20) NOT NULL,
HOSTTYPEBAR CHAR(20) NOT NULL,
LINE CHAR(10) NOT NULL)
CREATE TABLE COMP_COMP (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
LINE CHAR(10) NOT NULL,
HOSTSERIAL CHAR(20) NOT NULL,
HOSTTYPEBAR CHAR(20) NOT NULL,
HLINE CHAR(10) NOT NULL)
CREATE TABLE COMP_MUX (
HOSTSERIAL CHAR(20) NOT NULL,
HOSTTYPEBAR CHAR(20) NOT NULL,
HLINE CHAR(10) NOT NULL,
MSERIAL CHAR(20) NOT NULL,
MTYPEBAR CHAR(20) NOT NULL,
MLINE CHAR(10) NOT NULL)
CREATE TABLE COMP_PORTS (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
LINE CHAR(10) NOT NULL,
COM CHAR(5),
FLD CHAR(5),
INTERFACE CHAR(3),
BAUD NUMBER,
DATABITS NUMBER,
STOPBITS NUMBER,
PARITY CHAR(6),
HANDSHAKE CHAR(10),
EMULATION CHAR(10))

CREATE TABLE COMP_SW (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
LICENCE_NUM CHAR(20),
HOSTSERIAL CHAR(20),
HOSTTYPEBAR CHAR(20))
CREATE TABLE COMPUTER_BASE (
BSERIAL CHAR(20) NOT NULL,
BTYPEBAR CHAR(20) NOT NULL,
BMANUF CHAR(10),
BMODEL CHAR(10),
HOSTID_NUM CHAR(15),
HOSTID_NAM CHAR(10),
CPU CHAR(5),
MCTYPE CHAR(5),
MOUSE CHAR(1),
MATHCOPRO CHAR(1),
BASEMEM CHAR(5),
EXT_MEM CHAR(5),
TOTAL_MEM CHAR(5),
RAMREV CHAR(5),
ROMREV CHAR(5),
BIOSREV CHAR(5),
MODS CHAR(80),
KBD_SERIAL CHAR(20),
```

```
KBD_TYPEBAR CHAR(20),
KBD_MODEL CHAR(10),
SCR_TYPE CHAR(10),
SCR_SERIAL CHAR(20),
SCR_TYPEBAR CHAR(20),
SCR_MANUF CHAR(10),
SCR_MODEL CHAR(10),
NETWORK CHAR(10),
DIV CHAR(3),
DEPT CHAR(10),
LOCATION CHAR(10),
PURCH_ORD CHAR(15))

CREATE TABLE CONNECTION (
HOSTSERIAL CHAR(20) NOT NULL,
HOSTTYPEBAR CHAR(20) NOT NULL,
LINE CHAR(10) NOT NULL,
DSERIAL CHAR(20) NOT NULL,
DTYPEBAR CHAR(20) NOT NULL,
SWSERIAL CHAR(20) NOT NULL)
CREATE TABLE DATA_SWITCH (
SWSERIAL CHAR(20) NOT NULL,
INTERFACE CHAR(3),
MODE_TYPE CHAR(5),
NUM_PORTS NUMBER)
CREATE TABLE DEV_MAINT (
SUPPLIER CHAR(20) NOT NULL,
CONTRACT CHAR(20) NOT NULL,
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL)
CREATE TABLE DEV_USERINFO (
USERNAME CHAR(15) NOT NULL,
TELEPHONEXT NUMBER,
DIV CHAR(3) NOT NULL,
DEPT CHAR(10) NOT NULL,
LOCATION CHAR(10),
FSERIAL CHAR(20) NOT NULL,
FTYPEBAR CHAR(20) NOT NULL)
CREATE TABLE DISKDRIVE (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
MANUF CHAR(10),
MODEL CHAR(10),
INT_EXT CHAR(1),
FORMAT_DATE DATE,
CAPACITY CHAR(5),
TYPE CHAR(10),
DENSITY CHAR(2),
SIZE CHAR(5),
MAINT CHAR(5),
PURCH_ORD CHAR(15),
TAPE CHAR(1),
HOSTSERIAL CHAR(20),
HOSTTYPEBAR CHAR(20))
CREATE TABLE FAULT_HISTORY (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
REPORTED DATE,
```

```
CLEARED DATE,
MAINT_SUPPLIER CHAR(20),
FAULT_DESC CHAR(80),
WRK_DONE CHAR(80),
DIV CHAR(3),
DEPT CHAR(10),
LOCATION CHAR(10))
CREATE TABLE INP_DEV (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
MANUF CHAR(10),
MODEL CHAR(10),
TYPE CHAR(10),
FORMSIZE CHAR(5),
TAPETYPE CHAR(2),
DIV CHAR(3),
DEPT CHAR(10),
LOCATION CHAR(10),
PURCH_ORD CHAR(15))
/
CREATE TABLE INSTALLATION (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
INSTALL DATE,
OPERATIVE CHAR(20),
REASON CHAR(80),
MEMO_JOB_NUM CHAR(10),
STATUS CHAR(5))
CREATE TABLE IO_DEV (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
MANUF CHAR(10),
MODEL CHAR(10),
TYPE CHAR(10),
BOARDREV CHAR(5),
BOARDEMUL CHAR(10),
BUFFER CHAR(5),
SCREENMODE CHAR(10),
MODS CHAR(80),
DIV CHAR(3),
DEPT CHAR(10),
LOCATION CHAR(10),
PURCH_ORD CHAR(15))
/
CREATE TABLE LEASE (
LEASEID CHAR(20) NOT NULL,
CONTRACT CHAR(20) NOT NULL,
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL)
CREATE TABLE LEASE_DETAILS (
LEASEID CHAR(20) NOT NULL,
CONTRACT CHAR(20) NOT NULL,
AUTH_NUM CHAR(20),
SUPPLIER CHAR(20),
FIN_SUPPLIER CHAR(20),
QUART_CHARGE NUMBER (10,2),
START_DATE DATE,
END_DATE DATE,
```

```
PURCH_ORD CHAR(15))
CREATE TABLE MAINTENANCE (
SUPPLIER CHAR(20) NOT NULL,
CONTRACT CHAR(20) NOT NULL,
START_DATE DATE,
END_DATE DATE,
WARRENTY_END DATE,
PREV_EXPIREY DATE,
PURCH_ORD CHAR(15),
LEASEID CHAR(20),
LEASECONTRACT CHAR(20))
CREATE TABLE MOUSE (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
MANUF CHAR(10),
MODEL CHAR(10),
TYPE CHAR(10),
BUTTONS NUMBER,
PURCH_ORD CHAR(15),
HOSTSERIAL CHAR(20) NOT NULL,
HOSTTYPEBAR CHAR(20) NOT NULL)
CREATE TABLE MUX_DEV (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
MANUF CHAR(10),
MODEL CHAR(10),
TYPE CHAR(10),
BOARDREV CHAR(5),
COMMENTS CHAR(80),
DIV CHAR(3),
DEPT CHAR(10),
LOCATION CHAR(10),
PURCH_ORD CHAR(15))
CREATE TABLE MUX_DEVIO (
MSERIAL CHAR(20) NOT NULL,
MTYPEBAR CHAR(20) NOT NULL,
MLINE CHAR(10) NOT NULL,
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL)
CREATE TABLE MUX_PORTS (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
LINE CHAR(10) NOT NULL,
STATUS CHAR(10),
INTERFACE CHAR(3),
BAUD NUMBER,
DATABITS NUMBER,
STOPBITS NUMBER,
PARITY CHAR(6),
HANDSHAKE CHAR(10),
EMULATION CHAR(10),
LINEDRIVER CHAR(5))
CREATE TABLE NODE_COMPONENT (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
PREV_NWADDR CHAR(40),
LENGTH NUMBER,
CABLE_MEDIA CHAR(10),
```

```
TAP_NUM CHAR(5),
CABLE_SEGNUM CHAR(5),
ENDPOINT_CODE NUMBER,
NW_TYPE CHAR(10),
CABLE_TYPE CHAR(10))
CREATE TABLE NW_NODE_CONNECT (
ETHERNET_ADDR CHAR(20),
INTERNET_ADDR CHAR(15),
PROTOCOL CHAR(10),
INTERFACE_TYPE CHAR(10),
NIS_TYPE CHAR(6),
NW_TYPE CHAR(5),
CARDSERIAL CHAR(20) NOT NULL,
CARDTYPEBAR CHAR(20) NOT NULL)
CREATE TABLE NWCOMPONENT (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
MANUF CHAR(10),
MODEL CHAR(10),
REVISION CHAR(5),
DIV CHAR(3),
DEPT CHAR(10),
LOCATION CHAR(10),
PURCH_ORD CHAR(15),
TYPE CHAR(10),
DESCRIPTION CHAR(80),
SEGMENT_NUM CHAR(5),
NUM_PORTS NUMBER)
CREATE TABLE OUT_DEV (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
MANUF CHAR(10),
MODEL CHAR(10),
TYPE CHAR(10),
PAPERSIZE CHAR(10),
RIBBONTYPE CHAR(10),
MEDIA CHAR(10),
INTERFACE_BRD CHAR(10),
FEEDER CHAR(10),
LANGUAGE CHAR(10),
MODS CHAR(80),
DIV CHAR(3),
DEPT CHAR(10),
LOCATION CHAR(10),
PURCH_ORD CHAR(15))
/
CREATE TABLE PERIPH_COMMS (
PSERIAL CHAR(20) NOT NULL,
PTYPEBAR CHAR(20) NOT NULL,
STATUS CHAR(10),
INTERFACE CHAR(3),
BAUD NUMBER,
DATABITS NUMBER,
STOPBITS NUMBER,
PARITY CHAR(6),
HANDSHAKE CHAR(10),
EMULATION CHAR(10),
LINEDRIVER CHAR(5))
```

```
CREATE TABLE PLOTTER_CONFIG (
PLSERIAL CHAR(20) NOT NULL,
PLTYPEBAR CHAR(20) NOT NULL,
BYPASS CHAR(3),
HANDSHAKE CHAR(10),
REMOTE CHAR(10),
EAVESDROP CHAR(10),
PLOTMODE CHAR(10))
CREATE TABLE PORT_PORT (
MSERIAL CHAR(20) NOT NULL,
MTYPEBAR CHAR(20) NOT NULL,
MLINE CHAR(10) NOT NULL,
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
LINE CHAR(10) NOT NULL)
CREATE TABLE SOFTWARE (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
LICENCE_NUM CHAR(20),
PRODUCT_NUM CHAR(20),
MANUF CHAR(10),
SWNAME CHAR(15),
REVISION CHAR(5),
DESCRIPTION CHAR(80),
SWTYPE CHAR(10),
STATUS CHAR(10),
PURCH_ORD CHAR(15),
APPS_TYPE CHAR(5))
 CREATE TABLE TAPE_DISK (
DSKSERIAL CHAR(20) NOT NULL,
DSKTYPEBAR CHAR(20) NOT NULL,
TAPSERIAL CHAR(20) NOT NULL,
TAPTYPEBAR CHAR(20) NOT NULL)
CREATE TABLE TAPEDRIVE (
SERIAL CHAR(20) NOT NULL,
TYPEBAR CHAR(20) NOT NULL,
MANUF CHAR(10),
MODEL CHAR(10),
INT_EXT CHAR(1),
CAPACITY CHAR(5),
SIZE CHAR(5),
MAINT CHAR(5),
PURCH_ORD CHAR(15),
HOSTSERIAL CHAR(20),
HOSTTYPEBAR CHAR(20))
```

APPENDIX O

SQL*FORMS

The content of this wallet is a program listing of the SQL*Forms Implementation.

```
; Generated by SQL*Forms Version 3680.69.1 on Fri Mar  8 19:35:23 1991.
; Application owner is SCOTT.  Application name is ADDMAINTENANCE.
; (Application ID is 25)
; ----------------------------------------------
;Application Title :
!MAINTENANCE
;ORACLE workspace size :

;Block name / Description :
**KEY-STARTUP
;SQL>
#exemacro
copy GLOBAL.SERIAL into :HEADER.SERIAL;
copy GLOBAL.TYPEBAR into :HEADER.TYPEBAR;
/
;Message if value not found :

;Must value exist Y/N :
Y
select 'X' from DEV_MAINT
where :HEADER.SERIAL=DEV_MAINT.SERIAL
and :HEADER.TYPEBAR=DEV_MAINT.TYPEBAR
/
;Message if value not found :
*$FAILSAFE $STEP3 ERROR:THIS DEVICE IS ALREADY UNDER MAINTENANCE: Please re-enter
;Must value exist Y/N :
Y
$STEP3
#exemacro
copy :MAINTENANCE.CONFIRM into GLOBAL.FLAG;
clrrec;
exit;
/
;Message if value not found :

;Must value exist Y/N :
Y
$FAILSAFE
#exemacro null;

;Message if value not found :

;Must value exist Y/N :
Y
;Block name / Description :
**ADDEVICE
;SQL>
#exemacro
prvblk;
copy :MAINTENANCE.CONFIRM into GLOBAL.FLAG;
commit;
exit;

;Message if value not found :

;Must value exist Y/N :
Y
;Block name / Description :
```

```
**REJDEVICE
;SQL>
#exemacro
prvblk;
clrrec;
copy :MAINTENANCE.CONFIRM into GLOBAL.FLAG;
exit;

;Message if value not found :

;Must value exist Y/N :
Y
;Block name / Description :
DEV_MAINT/DEV_MAINT
;Table name :
DEV_MAINT
;Check for uniqueness before inserting Y/N :
N
;Display/Buffer how many records :
1
;Field name :
SUPPLIER
;Type of field :
CHAR
;Length of field / Display length / Query length :
20 / 20 / 20
;Is this field in the base table Y/N :
Y
;Is this field part of the primary key Y/N :
Y
;Field to copy primary key from :

;Default value :

;Page :
2
;Line :
4
;Column :
20
;Prompt :

;Allow field to be entered Y/N :
Y
;SQL>

;Is field fixed length Y/N :
N
;Auto jump to next field Y/N :
N
;Convert field to upper case Y/N :
Y
;Help message :
*Enter value for : SUPPLIER
;Lowest value :

;Highest value :
```

```
;Field name :
CONTRACT
;Type of field :
CHAR
;Length of field / Display length / Query length :
20 / 20 / 20
;Is this field in the base table Y/N :
Y
;Is this field part of the primary key Y/N :
Y
;Field to copy primary key from :

;Default value :

;Page :
2
;Line :
4
;Column :
60
;Prompt :

;Allow field to be entered Y/N :
Y
;SQL>
**KEY-NXTFLD
/
;SQL>
select 'X' from MAINTENANCE
where MAINTENANCE.SUPPLIER=:DEV_MAINT.SUPPLIER
and MAINTENANCE.CONTRACT=:DEV_MAINT.CONTRACT
/
;Message if value not found :
$STEP2 $ADDETAILS THIS SUPPLIER DOES NOT EXIST. Please enter details or Cancel/Exit
;Must value exist Y/N :
Y
$STEP2
#exemacro
goblk MAINTENANCE;clrblk;exeqry;
/
;Message if value not found :
$FAILSAFE $FAILSAFE
;Must value exist Y/N :
Y
$ADDETAILS
#exemacro
copy :DEV_MAINT.SUPPLIER into GLOBAL.SUPPLIER;
copy :DEV_MAINT.CONTRACT into GLOBAL.CONTRACT;
call IMAINTENANCE;
goblk MAINTENANCE;clrblk;exeqry;
/
;Message if value not found :

;Must value exist Y/N :
Y
$FAILSAFE
#exemacro null;
```

;Message if value not found :

;Must value exist Y/N :
Y
;Is field fixed length Y/N :
N
;Auto jump to next field Y/N :
N
;Convert field to upper case Y/N :
Y
;Help message :
*Enter value for : CONTRACT
;Lowest value :

;Highest value :

;Field name :
SERIAL
;Type of field :
CHAR
;Length of field / Display length / Query length :
20 / 20 / 20
;Is this field in the base table Y/N :
Y
;Is this field part of the primary key Y/N :
Y
;Field to copy primary key from :
HEADER.SERIAL
;Page :

;SQL>

;Field name :
TYPEBAR
;Type of field :
CHAR
;Length of field / Display length / Query length :
20 / 20 / 20
;Is this field in the base table Y/N :
Y
;Is this field part of the primary key Y/N :
Y
;Field to copy primary key from :
HEADER.TYPEBAR
;Page :

;SQL>

;Field name :

;Block name / Description :
MAINTENANCE/MAINTENANCE
;Table name :
MAINTENANCE
;Check for uniqueness before inserting Y/N :
N
;Display/Buffer how many records :
1

;Field name :
SUPPLIER
;Type of field :
CHAR
;Length of field / Display length / Query length :
20 / 20 / 20
;Is this field in the base table Y/N :
**Y
;Is this field part of the primary key Y/N :
Y
;Field to copy primary key from :
DEV_MAINT.SUPPLIER
;Page :
1
;Line :
4
;Column :
20

APPENDIX P

This wallet contains a small sample of the data collected about VDU's, Printers and Computers for input into the Database.

GANDALF VDU'S IN THE MAIN DRAWING OFFICE.

NAME	LOCATION	TEL	EQUIPMENT	SERIAL	LOG	WALL	SUBSCRIBER
MARTIN TONGUE	FLP DO	2604	VISA 125 D/O		MINI	1	S000020000
IAN BEDDER	FLPD.O	2604	VISA 125 D/O	210173	"	2	S000020001
SANDY REED	"	"	"	210222	MINI	3	S000020002
						4	
BOB TYE	FLPDO	2053	V125 04	215031	"	5	S000020004
TONY SWIFT	"	"	"	214678	"	6	S000020005
D HENDERSON	"	"	"	217428	"	7	S000020006
STUART PECK	LNDMKT DO	2614	"	217477	IND	8	S000 2007
CHRIS KILGOUR-MILLER	"	"	"	217997	"	9	S0002008
S ARNISTON	"	2040	"	217452	"	10	" " 9
M BERRINGTON	"	2047	"	186714	"	11	" " 10
D BEABLES	"	2040	"	217434		12	" 11
D ARD	"	"	"	214836	"	13	12
VACANT	"	2614	"	210497	"	14	13
S MARRIOTT	"	"	"	217406	"	15	14
A PRATT	"	2090	"	217403	"	16	15
Paul Mayer	"	2090	"	210318	"	17	16
C WILLIAMS	"	2090	"	209481	"	18	3001
B CLARKE	"	"	"	213311	"	19	3002
D FRENCH	"			217846		20	
A BINCH	"	"	"	217445	"	21	3004
C BROWN	"	"	"	215060	"	22	3005
H STERLING	"	"	"	215011	"	23	3006
NO VDU						24	NO VDU
T HICKIN	SUN D.O	2179	"	213451	SUN	25	3008
M MOLL	SUN D.O	2179	V125 D.O	213110	SUN	26	3009
GORDON HIGGINS	SUN D.O	2179	V125 D4	2129159	"	27	3010
D BULLER	SUN D.O	2086	V125 D4	217420	"	28	S000 4000
NO VDU						29	NO VDU
R HICKENBOTTOM	SUN D.O	2179	"	217910	SUN	30	3013
R.C. BEARD	SUN D.O	2179	V125 D4	214616	SUN	31	3014
D MISTRY	SUN D.O	2179	V125 D4	214998	SUN	32	3015
NO VDU	"	"				33	NO VDU
JOHN BUBBER!	SUN D.O	2179	"	213034	SUN	34	4014
D BURNS	SUN D.O	2179	V125 D4	217474	SUN	35	4013
L BANBURY	SUN D0	2179	V102 D4	217809	SUN	36	4012
G ARCHER	"	"	"	217903	"	37	4011
D TICKLETT	"	"	"	217939	"	38	4010
A HUTCHINSON	"	"	"	212913		39	4009
T CROCCOCK	SUN D.O	2086	V125 D4	217412	SUN	40	4008
C BOWEN	SUN D.O	"	"	217477	SUN	41	4007
R CLARK	"	"	"	217911	SUN	42	4006
J HARRIMAN	"	"	"	217401	SUN	43	4005
M BALL	"	2179	"	213117	SUN	44	4002
	"	"	"	213452	"	45	4003
A J ASHLEY		2617	V25 D4	939359	HB	G27	S0005003
D BIDDLES	IND DES	2060	V25 D4	217848	HB	G25	S0005001
KEVIN WATSON	IND DES	2062	"	939792	HOSE	G24	S0005000
MR CORIGHT	SUN MC DES	2617	V125 04	944771		G/26	S0005002
ANDREW SHORE	FLP DO	2052	VISA 125 D/O	213473		G/30	S0005006

Vacant Wall Sockets

DEPARTMENT	FLOOR SOCKET NO	NOTES
TRC PRODUCTION CONTROL	FLD 6/16	VDU HAS BEEN MOVED?
TRC PRODUCTION CONTROL	FLD 7/7	VDU HAS BEEN MOVED?
TRC PRODUCTION CONTROL	FLD 7/6	VDU HAS BEEN MOVED?
TRC PRODUCTION CONTROL	FLD 7/8	VDU HAS BEEN MOVED?
TRC PRODUCTION CONTROL	FLD 7/5	VDU HAS BEEN MOVED?
RMD PRODUCTION CONTROL	FLD 4/16	VDU HAS BEEN MOVED?
RMD PRODUCTION CONTROL	FLD 5/08	VDU HAS BEEN MOVED?
RMD PRODUCTION CONTROL	FLD 4/13	VDU HAS BEEN MOVED?
RMD COMMERCIAL	COM 1/76	HAVE NO VDU.
RMD COMMERCIAL	COM 1/75	HAVE NO VDU.
RMD COMMERCIAL	COM 1/112	HAVE NO VDU.
RMD COMMERCIAL	COM 1/111	HAVE NO VDU.
RMD COMMERCIAL	COM 1/108	HAVE NO VDU.
RMD COMMERCIAL	COM 1/21	HAVE NO VDU.
RMD COMMERCIAL	COM 1/74	HAVE NO VDU.
RMD COMMERCIAL	COM 1/73	HAVE NO VDU.
RMD COMMERCIAL	COM 1/110	HAVE NO VDU.
RMD PURCHASING	FLD 7/17	NO VDU.

Vacant Wall Sockets

DEPARTMENT	FLOOR SOCKET NO	NOTES
BEM PRODUCTION SERVICES	FLD 7/18	HAVE BEEN MOVED?
BEM PRODUCTION SERVICES	FLD 7/19	HAVE BEEN MOVED?
BEM PRODUCTION SERVICES	FLD 5/44	HAVE BEEN MOVED?
BEM PRODUCTION SERVICES	FLD 5/45	HAVE BEEN MOVED?
BEM PRODUCTION SERVICES	FLD 5/37	HAVE BEEN MOVED?
BEM PRODUCTION SERVICES	FLD 5/36	HAVE BEEN MOVED?
TRC 54 STORES	FLD 5/31	HAVE BEEN MOVED?
TRC 54 STORES	FLD 5/1	HAVE BEEN MOVED?
TRC DO MID FLOOR	COM 1/86	NOTHING PLUGGED IN?
DAX DESIGN OFFICE	NO 4.	VACANT?
RMD WINDING PROCESS	X 6	No Labelled wall sockets.
BEM FAB03 26 SHOP. ROGER SUTTON	X 6	No Labelled wall sockets.
TRC TQME	X 5	No Labelled wall sockets.

PRINTERS

DEPARTMENT	TEL	MAKE/MODEL	SERIAL Nº	FLOOR Nº	QUE	USE
P.S.G		EPSON FX100+	0371_17	NO LABEL		VARIOUS, HOST D
R&D GRAPHICS	2065	QUME 9	3056603	C 2/7		HOST A, H-CODE
R&D GRAPHICS	2070	BROTHER HR15XL	A63368918	F 5/40		HOST G, MICROFICHE
TRC PRODUCTION CONTROL	2542	FACIT 8355Ø	8470125	F 5/29		HOST G
TRC PRODUCTION CONTROL	2542	FACIT 4514	8250146	F 5/28		HOST G
REM TECHNICAL LOST		EPSON FX100	839492	F 5/27	CST	HOST G,
RMD COMMERCIAL SPARES		FACIT 4514	7350358	C 1/44		HOST
TRC PRODUCTION CONTROL		FACIT 4514	8520272	F 7/37		HOST
RMD GOODS RECIEVED		FACIT 4513	9460210	F 5/35	RGG	HOST, 12
TRC COMMERCIAL SPARES		FACIT 4514	8430182	C 1/67		HOST
RMD PURCHASING		EPSON DFX5000	ØG4ØØØØ730	F	RPUR	HOST G, 10
RMD PURCHASING		FACIT 4514	7350360	F	$RPUR	HOST G, 122
TRC PDLDO	2672	FACIT 4514	8150500	F 7/39		HOST G,
TRC GOODS RECIEVED		EPSON LX80	Ø34896			HOST
TRC DO TOP FLOOR	2521	FACIT B3550	8480031	FLD 1/118	RTM	HOST D, PARTS LISTS, 61
TRC DO MID FLOOR	7255	FACIT 4514	8250132	FLD 7/32	TGR	HOST G, 129
TRC DO GRN FLOOR	7260	BROTHER HR15XL		FLD 5/42		HOST G, MICRO-FICHE 111
TRC DO TOP FLOOR	2521	DG TP1			TRN	HOST A, 10
TRC ENGINEERING	2021	QUME9		COM 2/19	LQP1	HOST A 7

PRINTERS

DEPARTMENT	TEL	MAKE/MODEL	SERIAL Nº	FLOOR Nº	QUE	USE
WINDMILL ROAD	2051	FACIT 4540				HOST G SHORTAGE LISTS.
WINDMILL ROAD	2051	FACIT 4514	0020083	[illegible]	[illegible]	[illegible] PC
DAX DO		FACIT 4514			DAX	HOST D, 36
SYNCHRONUS	2060	FACIT 4542		COM 1/96	TECS INDTESSIM	HOST B, PRINTING CALCS PROGRAMS
SYNCHRONUS	2060	HP 7550A	52288	COM 1/78	PLT	HOST B PLOTS OF VARIOUS SORTS
SYNCHRONUS	2060	FACIT B3580		EXO 6/33	PLIS	HOST G, PARTS LISTS.
DAX DES OFFICE	2609	RXP4450	0BMA2005012	COM 1/56	DAX	HOST B PROGRAMS 23
RMD PROD CONTROL	2125	FACIT B3550	A040020	FLO 4/60	PROD	HOST G 1/17
RMD PROD CONTROL	2125	FACIT B3550		FLO 6/27		HOST G PARTM
BEM PICS.						

SUPPLEMENT 1

Con	Floor Skt	User	Department	Phone	VDU type	Serial No	Attached Device
96	FLD 5/30	STEVE COPPEL	TRC PRODUCTION CONTROL	7345	TATUNG 4200A	40611138	
HOST: G DATASWITCH LINKED		J. HAMILTON	TRC PRODUCTION CONTROL	7346	LOG200	E2-251078-13	
SUP 1.1							

Con	Floor Skt	User	Department	Phone	VDU type	Serial No	Attached Device
32	F 4/12	Barbara Lambert.	RMD PRODUCTION CONTROL	2410	D2	12038	
HOST: G. DATASWITCH LINKED		Mark Ledger	RMD PRODUCTION CONTROL	2174	VISA125 D410	943 641	
SUP 1.2							

Con	Floor Skt	User	Department	Phone	VDU type	Serial No	Attached Device
29	F 5/7	Barry Nicholl	RMD PRODUCTION CONTROL	2406	TATUNG 4200A	21810813	
HOST: G DATASWITCH LINKED		David Keates	"	2183	VISA— D410	445486	
SUP 1.3							

SUPPLEMENT 2

Con	Floor Skt	User	Department	Phone	VDU type	Serial No	Attached Device
156	FLR 7/38	CHRIS MOSS	TRC LOCO PRODUCTION CTRL	7352	VISA125 D410	101148	
HOST: G DATASWITCH LINKED		MAXINE O-FLYNN	TRC LOCO PRODUCTION CTRL	7352	VISA125 D410	210268	
SUP 2.1							

Con	Floor Skt	User	Department	Phone	VDU type	Serial No	Attached Device
104	F	Jam, Jamum.	RMD77 WOOD INSULATION.	2503	LOG200	EZ-244101-09	
HOST: G. DATASWITCH LINKED		Jim Linnett.	RMD PROCESS.	2440.	TATUNG DDT. 6200A.	40610994.	+ EPSON FX-100
SUP 2.2							

Con	Floor Skt	User	Department	Phone	VDU type	Serial No	Attached Device
11	C 1/120	F BALL	IND DES D.O	2117	TAT	40710134	
HOST: DATASWITCH LINKED		D COTTINHAM	SUN DES D.O		V.D.U IS PLUGGED IN THE GANDALF		
		D BIDDLES	IND D.O	2060	V.D.U. is plugged in the Gandalf.		
SUP 2.3							

PORT SELECTOR

Port Number	User	Department	Phone	VDU type	Serial No	Attached Device
1.001						
1.002	Sam Adams	Applications CAE	2181	VISA125 D410	183839	COM 2/72
1.003	Ron Stevenson	Applications DB/Quality	2197	VISA125 D410		COM 1/62
1.004	Jim Smith	Technical Support	2655	PC	"	COM 2/31
1.005	Janet Mann	Applications Sales/Pre	2687	VISA125 D410	123614	COM 2/41
1.006	Jerry Johnson	Technical Support.	2688	PC	"	COM 3/5
1.007		CAD CENTRE				
1.008						
1.009	Ian West	Technical Support	2688	VISA125 D410	210660	COM 3/4 & NCPFS1
1.010						
1.011	Alicia Haw	Computer Resources.	2342	VISA125 D410		COM 3/10 EIA.
1.012	All Cost office	TRC COST OFFICE	2488	D2	26076	None label
1.013	John Anthony	Applications Eng/Prod	2621	VISA125 D410		COM 2/61
1.014						
1.015						
1.016	RACAL	UPPER MUX PORT 31	ICD.			
1.017	RACAL	UPPER MUX PORT 32	ICD.			
1.018	Ian Baker	Edit/BEM FINANCE	2267	D2	37496	COM 3/1
1.019						

HOST G

Con	Floor Skt	User	Department	Phone	VDU type	Serial No	Attached Device
2	MODEM	KEN LAWRANCE	WINDMILL ROAD	2076	D200		WML PROD
3	MODEM	SUE THORLEY	WINDMILL ROAD	2051	FACIT 4542	345-0039	PRTD PRINTER-
4	MODEM	SUE THORLEY	WINDMILL ROAD	2051	DASHER D200		
5	MODEM	NORMAN WINSON	WINDMILL ROAD	2171	LOG200		+RX80,
6	SUP 3-1						Data Switch
7	MODEM	GORDON BRAMWELL	WINDMILL ROAD	2050	TATUNG 4200A	40710131	
8	MODEM	SUE THORLEY	WINDMILL ROAD	2190	DASHER D410	GG000476	
9	FLD 5/27	CST	BEM TECHNICAL COST	2252	EPSON FX100	839492	
10	FLD	RPUR	RMD PURCHASING	2235	EPSON DFX5000	0G40000730	
11	F 5/13	John Byrne	BEM TECHNICAL COST	2252	D2	14106	
12	FLD 5/35	RGG	RMD GOODS RECIEVED		FACIT 4513	9460210	
13	F 4/55	AU COST OFFICE	RMD COST OFFICE	2260	D200	D0024814	
14							PORT-SELECTOR
15							PORT-SELECTOR
16							PORT-SELECTOR
17							PORT-SELECTOR
18	F 4/07	Ian Starland	RMD PRODUCTION CONTROL	2125	LOG200	E2-234007	+EPSON RX80
19	F 4/08	Don Blore	RMD PRODUCTION CONTROL	2351	TATUNG 4200A	40510016	
20	F 4/09	Valerie Linkon	RMD PRODUCTION CONTROL	2403	D2	5324	

HOST G

Con	Floor Skt	User	Department	Phone	VDU type	Serial No	Attached Device
21	F 4/10	Pat Newton	RMD PRODUCTION CONTROL	2403	LINK— D410	944933	
22	F 4/11	Selina Lee	RMD PRODUCTION CONTROL	2403	D211	01536	
23							
24	SUP 3-2						
25	F 6/25	Pam Marriot	Steel Stores	2362	Visa125 D410	213616	
26	F 4/15	Roger Bailey	RMD PRODUCTION CONTROL	2399	VISA125 D410	123615	
27	FLD 4/16	ALAN BADGER	BEM AC MOTORS PC	2472	TATUNG		
28	F 4/17	Pete Wooley	RMD PRODUCTION CONTROL	2027	VISA125 D410	189885	
29	SUP 1-3						
30	f6/17	mike reid	FAB	2392	D2	26078	
31	FLD 4/20	Ian Phillips	19 SHOP AC.	2405	LOG200.		+RX80, 822392
32	SUP 1-2						
33	NO LABEL	JACK WARNER	BEM86 STORES	2364	D200		
34	NO LABEL. FLD	Gordon Whiteman.	BEM18 SHOP DO. PRN/STATION.	2432	D200.		
35	FLD 4/24	Bahl	RMD FEEDER PC	2355	D200	D00000 837	
36	F 4/25	Morris Deacon.	DAX STORES	2018	VISA125 D410	123791.	
37	NO LABEL	Julian French	14 STORES.	2350	D200		RMD.PROD
38	FLD 4/27	Graham Vallone	19 STORES, 94 STORES	2404	D200		RMD.PROD
39	4/205.	Pete Patel.	RMD 32. STORES.	2.222	D200		

HOST G

Con	Floor Skt	User	Department	Phone	VDU type	Serial No	Attached Device
~~141~~	F 7/9	Pamela Sood	TRC PURCHASING	7316	TATUNG DDT 4200A	Unrecognisable	
~~142~~	F 7/11	MAVIS BURTON	PICS.	2265.	VISA125 D410	38691	
~~143~~	F 7/12	DINA ROSCOE	PICS ✓	2265	VISA125 D410	101243	
~~144~~	F 7/13	KATE CLARKE	PICS. ✓	2265	VISA125 D410	41999	
~~145~~	F 7/14.	PAT COLINS.	PICS.	2265.	VISA125. D410.	123789	
146	COM 1/19	PIC	PICS.	2265	FACIT 4514	7350763	
~~147~~	F 7/23	M.A. OSWIN	RMD FEEDER PC	2435	D211	289088	
~~148~~	FLD 7/16	ANDREW GARDNER	BEM BOUGHT LEDGER	2258	VISA125 D410	207282	
~~149~~	F 7/26	Zoe Handon	RMD PRODUCTION CONTROL	2109	VISA125 D410	213267	
~~150~~	F 7/27	Andy Bailey	RMD PRODUCTION CONTROL	2109	D200	none	
~~151~~	F 7/30	Kieth Tebbit	RMD PRODUCTION CONTROL	2396	VISA125 D410	123 602	
~~152~~	FLD 7/31	TRACEY PRESTON	TRC PD MIDDLE FLOOR	7256	VISA125 D410	123245	
~~153~~	FLD 7/34	KIETH ESTELMONT	TRC PD TOP FLOOR	2521	VISA125 D410	123237	
154							disposed
~~155~~	f5/36	Pebe Robinson	TRC goods rec	2652	VISA125 D410	123750	
156	SUP 2.1						
~~157~~	f 7/40	Paul Hosteq	TRC PD LDO	2358	VISA125 D410	122932	
~~158~~	f6/18	carl Andrews	26 shop FAB 03 BEM	2187	VISA125 D410	115685	
~~159~~	f6/19	Pet Hughes	FAB	2312	VISA 125 D410	176032	
~~160~~	F 6/20	P. Shervin	RMD FEEDER PC	2299	VISA125 D410	176069	

HOST G

Con 161	Floor Skt	User	Department	Phone	VDU type	Serial No	Attached Device
~~162~~	F 6/21	Neil Moyer	RMD FEEDER PC	2105	D2	91-6995	GANDALF G
163							GANDALF G
164							GANDALF G
165							GANDALF G
166							GANDALF G
167							GANDALF G
168							GANDALF G
169							GANDALF G
170							GANDALF G
171							GANDALF G
172							GANDALF G
173							GANDALF G
~~174~~	F 5/25	D. Allen	RMD SUBCONTRACTS FEEDER	2641	LOG200	244119-09	+ EPSON RX-80
175							RMD.PROD
~~176~~	F 6/14	Barbara Lambert	RMD PRODUCTION CONTROL	2410	VISA125 D410	215017	
~~177~~	FLD 6/33	PLIS	BEM SYN MC DO	2060	FACIT B3550		

name: ROCKET	type: 4/360.	user: Sarah Griffiths.	dept: TRC Project Planning.	2.689.

TTY	Floor Socket	User	Department	Phone	VDU type	Serial	HST $	CON #	DS y/n	H-H y/n	VDU y/n	Notes
a	Serial A	"	"	"	Facit A1610	850 0249						
b												
H0	SUN Ø	"	"	"	VT34Ø	TA00444646						
H1	SUN ONE	David Bryant	"	2779	VT32Ø	HK94376048						
H2	SUN TWO	Mark Savage	"	2779	VT32Ø	HK94376046						
H3	SUN THREE	Andy Herd	"	2518	VT32Ø	HK94376054						
H4	SUN FOUR	Noel Blake	"	2746	VT32Ø	HK94376045						
H5	SUN FIVE	Sarah Griffiths.	"	"	VT32Ø	SA01487849						
H6	SUN SIX	"	"	"	VT32Ø	SA017C8106						
H7												
H8												
H9												
HA												
HB	TTYH6	John Robson.	TRC PO LDO	2358	PC M55.	001381						
HC												
HD												
HE												
HF												

APPENDIX Q

ALTERNATIVE DESIGNS

The contents of this wallet is a sample of the alternative screen design and method of operation, (input and output).

These were produced with a standard 3GL language in mind. After these ideas and alternative designs were produced and developed, it was clear that it would not be acceptable using this old conventional style of operation for reasons of ease of use, clarity and efficiency.

TOP LEVEL MENU LØ.X

(1) HELP
(2) ENQUIRY
(3) ADD
(4) DELETE
(5) UPDATE
(6) HELP DESK
(7) SQL MANUAL MODE

LØ.2

(1) LIST
(2) REPORT
(3) GRAPHICAL

LØ.2.1

(1) H.WARE
(2) S.WARE
(3) COMMS
(4) SYSTEM
(5) LEASE
(6) USER/LOCATION
(7) MAINTAINANCE
(8) FAULTS
(9) INSTALLATION

LØ.2.1.1

(1) COMPUTER BASE UNIT
(2) INPUT DEVICE
(3) OUTPUT DEVICE
(4) IO DEVICE
(5) OTHER DEVICE
(6) DISK
(7) TAPE
(8) CARDS
(9)

L.Ø.2.1.1.

CLICK AND ENTER KNOWN INFO:-
SORT BY

SERIAL #
TYPE BAR #
MAKE
MODEL
HOST ID #
HOST ID
MOUSE
MATHS COPRO
CPU
TYPE
LOCATION
LEASE/PURCHASE ORDER #
KEY BOARD TYPE BAR #
SCREEN TYPE BAR #
SCR S/N
SCR MAKE
SCR MODEL
SCR SIZE
SCR TYPE
N/W TYPE

LØ.2.1.1.2
INPUT DEV.

SERIAL #
TYPE BAR #
TYPE
MAKE
MODEL
MAX. form SIZE
TAPE TYPE
LOCATION
PURCH. ORDER #
STATUS
INTERFACE

LØ.2.1.1.3
OUTPUT DEV

SERIAL #
TYPE BAR #
MAKE
MODEL
TYPE
MAX. PAPER SIZE
RIBBON TYPE
MAIN MEDIA
INTERFACE BOARD
FEEDER MECH.
LANGUAGE
LOCATION
PURCH. ORDER #
STATUS
INTERFACE

LØ.2.1.1.4
I/O DEV.

S/N
TYPE #
TYPE
MAKE
MODEL
BOARD REV
EMULATION
SCREEN MODE
LOCATION
PURCH. ORDER #
STATUS

LØ.2.1.1.5
OTHER

S/N
TYPE BAR #
TYPE
MAKE
MODEL
BOARD REV.
EMULATION
PURCH. ORDER #
STATUS

LØ.2.1.1.7
DISK

S/N
TYPE BAR #
MAKE
MODEL
INT. EXT.
CAPACITY
TYPE
DENSITY
SIZE
PURCH. ORDER #
TAPE

LØ.2.1.1.8
TAPE

S/N
TYPE BAR #
MAKE
MODEL
INT. EXT.
CAPACITY
SIZE
PURCHASE ORDER #

LØ.2.1.1.9
CARDS

S/N
TYPE BAR #
MAKE
MODEL
BIT
REV
TYPE
PURCH. ORDER #
MEM. CAP.

LØ.2.1.2
S.W

(1) FIND BASE UNITS FOR A PARTICULAR S/W ITEM

(2) FIND S/W FOR A SPECIFIED BASE UNIT

(3) LIST S/W

LØ.2.1.2.1

enter

LICENCE #

SERIAL #

TYPE BAR #

HOME

REVIS

MAKE

DESCR.

STATUS

PURCH. ORDER #

TYPE

Exit ☐ Continue ☐

OUTPUT

DEVID

MAKE

MODEL

LOCATION

USER

LØ.2.1.2.2

enter

DEVID

LØ.2.1.2.3

AS LØ.2.1.2.1

OUTPUT

ALL details filled in

LØ.2.1.3.1

SPECIFY → fills in missing blanks → Starting at first rec. → LIST summary if device attached → Extended data

HOST ID
Line #
com #
A.D #

Comms info y/N

device details y/N

LØ.2.1.3.2

SPECIFY DEVICE DETAILS → LIST connections for each

DEVID
MAKE
MODEL
TYPE
HOST ID
LOCATION

Comms info. y/N

LØ 2.1.3.3.

Specify host ID → Select * from comp. ports where comp. ports, HOST ID #, LINE # NOT IN

(Select HOST ID, LINE #, from connection)

AND NOT IN

(Select HOST ID, LINE # from comp comp (comp MUX))

LØ.2.1.3.4

Specify Data SW # → LIST HOST ID + LINE # from connection
then list devices on this Data Switch
LIST DEVID's + details for this particular DS #

LØ.2.1.3 5

Same as LØ.2.1.3.1

LØ 2.1.3 6

ENTER - LOCATION
DEVICE TYPE
HOST ID
DATA/C

Number of records selected . —

Display Details . Y/N

(!* Display of all relevant details)

L0.2.1.1.2c

DISPLAY AREA

Rec 1: —
—
—

Select □

Rec 2: —
—

□

ATTACHED KIT

DISK	TAPE	CARDS
1. CAPACITY INTEXT TYPE	1. CAPACITY SIZE	1. TYPE MAKE
2. —	2. —	2. —
—	—	—
		3. —

CLICK TO EXPAND ON ITEM

CONTROL MENU

(1) PRINTER OUTPUT

(2) DISPLAY NEXT REC.

(3) EXIT TO PREVIOUS MENU

(4) LIST ATTACHED EQUIP

(5) (BASE UNIT ONLY) SUMMARIZE BY LOCATION

(6) EXPAND DETAIL ON SELECTED RECORD.

(7) DISPLAY S/W LOADED (BASE UNIT ONLY)

(8) DISPLAY COMMS

(9) USER INFO

(10) MAINT. DETAILS

(11) DISPLAY FAULTS

(12) INSTALLATION DETAILS

(13) NETWORK

(14) RELEASE

LØ.2.1.3

(1) LIST DEVICE DETAILS FOR A GIVEN HOST CONNECTION

(2) LIST HOST CONNECTION DETAILS FOR A GIVEN DEVICE

(3) LIST UNALLOCATED HOST CONNECTIONS FOR A GIVEN HOST

(4) LIST CONNECTIONS FOR A SPECIFIED DATA SWITCH

(5) LIST COMMS INFO. FOR A GIVEN HOST CONNECTION

(6) LIST COMMS POINTS FOR A PARTICULAR LOCATION

(7) LIST HOST CONNECTIONS FOR A GIVEN MUX DEVICE

UNIX AS THE OFFICE AUTOMATION STANDARD

UNIX 5.4 is emerging as the operating system standard for workstations. In the past UNIX has been slow to take off mainly due to all the different implementations available. However, the Open Systems Foundation (OSF) which consists of many different major manufactures such as SUN, ICL, DEC, AT&T etc. decided it was time to standardise. All the good aspects of all the differing versions of UNIX such as BSD 4.2 (Berkeley Standard Distribution) have been combined to form UNIX 5.4. This was co-written by SUN microsystems and AT&T on behalf of OSF.

APPENDIX V

The contents of this wallet contains a more detailed description of the type of hardware necessary to implement the new system.

SPARCstation IPC and SPARCstation IPC GX

Sun's SPARCstation™ IPC and SPARCstation IPC GX graphics systems give users the power, high-resolution displays, expandability, and networking capabilities of high-performance workstations—at prices lower than high-end PCs.

Smaller and lighter than any computer of its kind, the SPARCstation IPC provides the processing power, disk capacity, and expansion capabilities found in more expensive systems. The SPARCstation IPC offers a choice of color and monochrome displays, up to 24 MB of RAM, an MS-DOS-compatible floppy disk drive, and both internal and external disk capacity. Every diskfull SPARCstation IPC system includes the intuitive OPEN LOOK® graphical user interface and DeskSet™ productivity tools, making the powerful UNIX® operating system and network easy to use.

With built-in networking capabilities and more than 2100 available SPARCware™ solutions—including the industry's most popular spreadsheet, desktop-publishing, word-processing, and database packages—the SPARCstation IPC is ideal for increasing productivity.

The SPARCstation IPC GX offers built-in graphics acceleration, fast text, and a responsive windowing environment for PC CAD, EDA, MCAD, and electronic publishing applications. Combined with the most popular PC CAD packages—AutoCAD, Personal Designer, CADKEY, and VersaCAD—the SPARCstation IPC GX delivers a superior solution. The SPARCstation IPC offers workstation advantages such as high-performance computing, graphics, networking, and multitasking for the same price as high-end PCs configured for graphics.

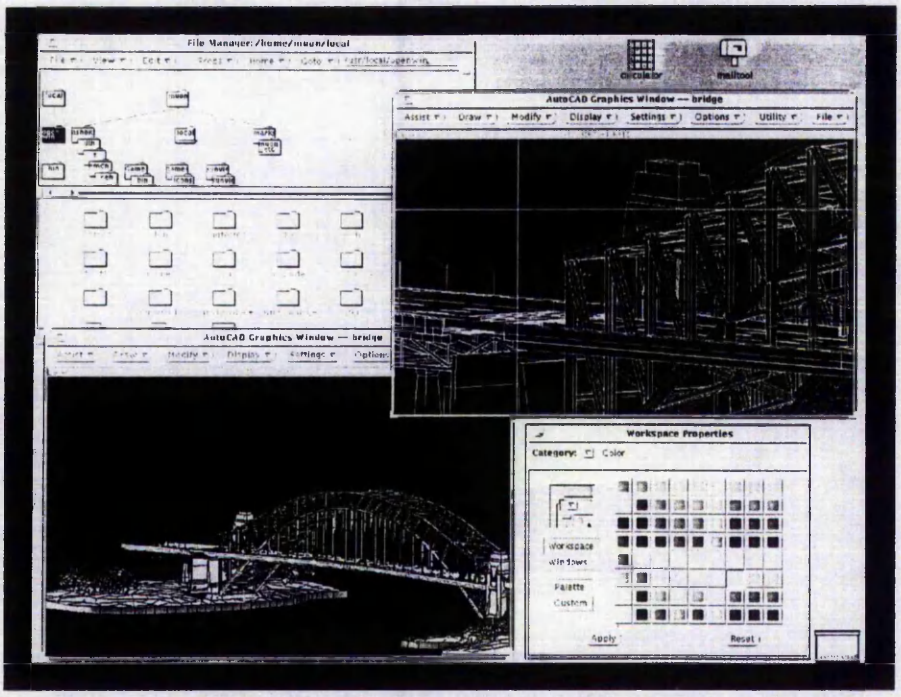
Features	Benefits
High Performance	
25-MHz SPARC® integer floating-point unit	▪ Sun's RISC architecture provides superior price/performance
11.8 SPECmarks (15.8 MIPS and 1.7 MFLOPS), 8-MB RAM	▪ Power and memory to quickly process many large applications simultaneously
Industry-leading SunOS™ operating system (preinstalled on diskfull systems)	▪ UNIX power for multitasking; high performance for network-based applications
Flat-profile, high-contrast 1152 × 900 high-resolution monitors	▪ Three times the pixels of standard PCs, allowing quality display of entire pages or multiple window sessions
Built-in Networking	
Built-in Ethernet® port (standard thick Ethernet) can be connected to twisted pair or thin Ethernet with a transceiver	▪ Allows quick and easy connection to computers on a standard, high-performance network
Sun's ONC™ open systems distributed computing environment	▪ Provides powerful networking capabilities for small to large networks, including support for connectivity to PC and mainframe systems
Easy to Use	
Advanced ease-of-use features:	▪ Allow everyone to take advantage of the powerful UNIX operating system
– OPEN LOOK graphical user interface	▪ Graphical, mouse-driven user interface with multitasking windows and pop-up and pull-down menus makes full-featured UNIX applications intuitive and easy to learn
– OpenWindows™ DeskSet environment preinstalled on diskfull systems (includes Calendar Manager, Mail Tool, File Manager, and other network-based tools and utilities)	▪ Powerful set of group productivity tools that leverage network resources
– SunOS 4.1.1 preinstalled on the disk	▪ Plug-and-play installation
– Easy-to-use PC-style manuals	▪ Save time on installation and referencing
Expandable and Configurable	
8-MB onboard memory expandable to 12 or 24 MB	▪ Lets users tailor systems to meet specific requirements ▪ Allows users to add memory as needed to store more data in fast local memory
Two high-bandwidth SBus slots	▪ Fast transfer of large amounts of data ▪ Open bus; add-on cards available from many vendors ▪ User installable; no jumpers or switches
Five built-in I/O ports:	▪ Allows connections to popular peripherals and other computers without using SBus expansion slots
– Ethernet port (standard thick Ethernet)	▪ Quick and easy network connection
– Two RS-423 serial ports	▪ RS-232C compatible; for easy integration of modems, printers, and other I/O peripherals
– SCSI-2 port	▪ Provides access to CD-ROM drives, hard disks, tape devices, and other I/O peripherals
– Audio I/O port	▪ Sound capabilities for applications such as multimedia mail
207-MB internal hard disk	▪ Large internal disk capacity for local storage

Features	Benefits
Expandable and Configurable (continued)	
External disk capacity of up to 2.7 GB	▪ Provides very large storage capacity when needed
Internal 3.5-inch MS-DOS-compatible floppy disk drive (1.44-MB and 720-KB formats)	▪ Enables easy transfer of data and applications, including MS-DOS files when used with Sun DOS Windows
Color or monochrome monitors available	▪ Choose monitors to fit application needs
Compact packaging	▪ Small footprint saves desk space
Standards Compliant	
SPARCstation IPC meets the SPARC International SPARC Compliance Definition 1.0	▪ SPARC compatibility, access to a wide range of SPARCware applications
SunOS 4.1.1 meets the following industry standards:	
IEEE POSIX Standard 1003.1-1988	▪ Portability standard for government and Fortune 500
X/Open XPG3 Component branded and XPG2 BASE branded*	▪ Application portability standards for European markets
System V Interface Definition Issue II	▪ SunOS 4.1 and 4.1.1 offer development environment for SVR4 source-compatible applications
Monitors meet international operational requirements for agency compliance for emissions, health and safety	▪ 76-Hz vertical refresh rate reduces eye fatigue ▪ Antiglare standard on all monitors ▪ Easily accessible operating controls ▪ Improved viewing environment

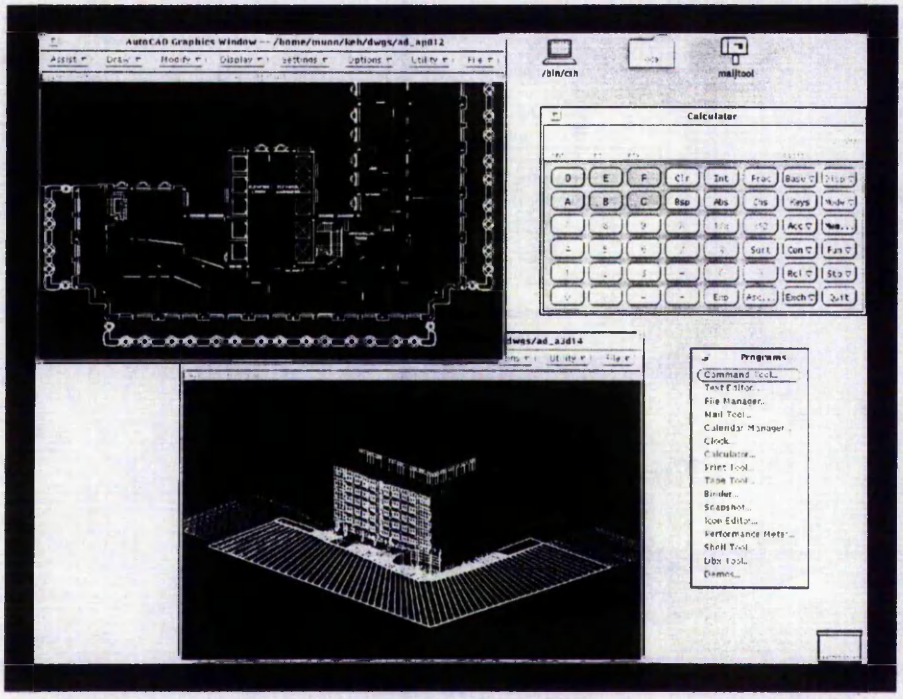
*XPG3 trademarks are applied to products operating in specific hardware/software environments. Consult the applicable XPG3 Conformance Statement for details about registered products. The Conformance Statement may be obtained from your Sun sales office. See *SunOS 4.1.1 Release Manual*, Appendix E.

SPARCstation IPC GX

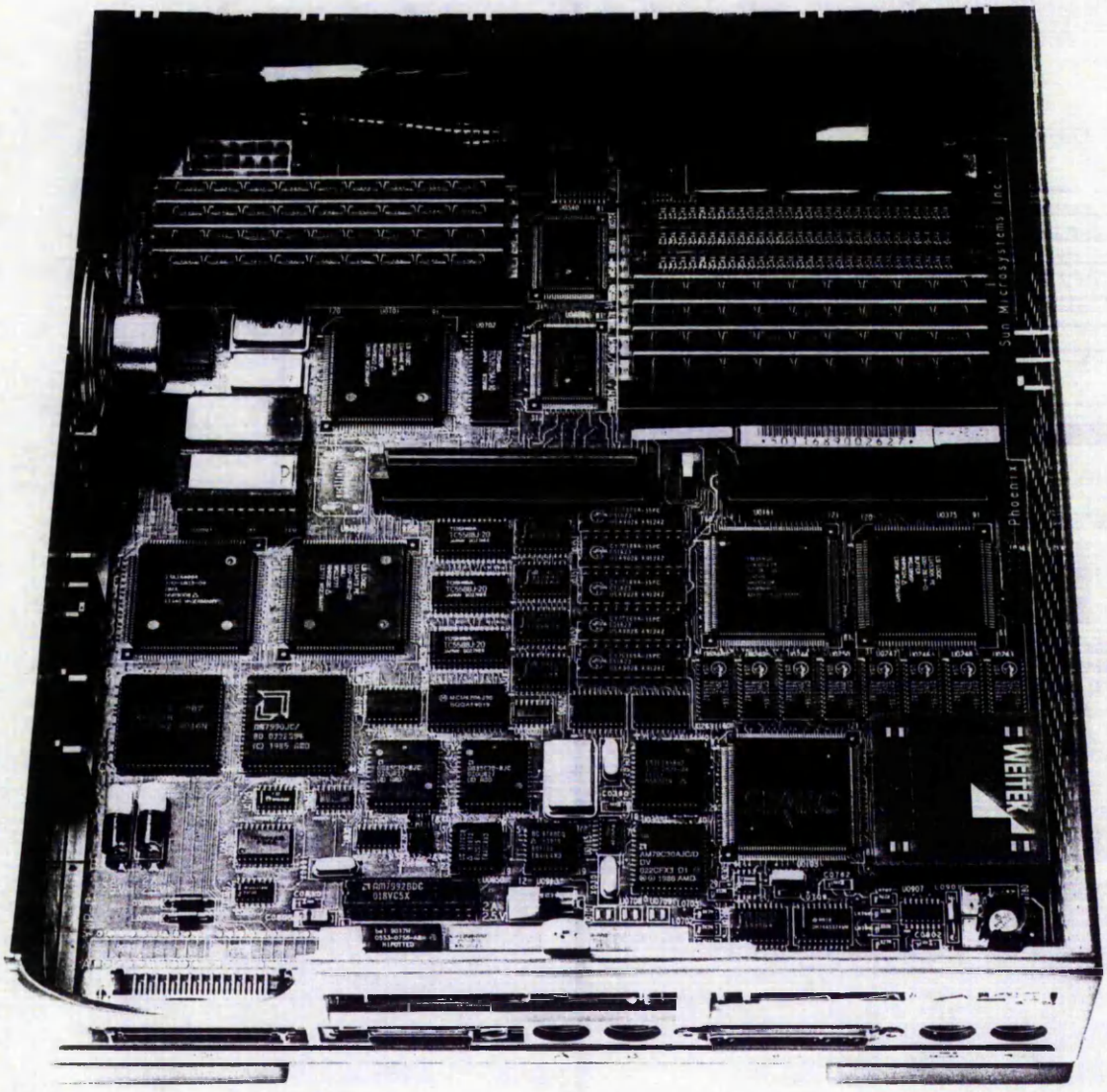
Additional Features	Benefits
Built-in graphics acceleration	▪ No additional cost for add-on boards; integrated solution
Accelerates 2-D and 3-D wireframe graphics	▪ Allows interactive manipulation of complex 2-D and 3-D graphical models
Accelerates text scrolling and window performance	▪ Faster response time increases user productivity
8-bit color support; displays 256 colors from color palette of 16.7 million	▪ More realism and clarity in complex models
Compatible with Sun's graphics libraries: Xlib, PostScript,® SunGKS,™ XGL,™ SunPHIGS,™ SunVision™	▪ Delivers transparent acceleration of applications



Create complex 3-D models easily with realism and clarity. Take advantage of Sun's high-performance windowing system on the SPARCstation IPC GX.



Simultaneously view 2-D and 3-D designs from multiple angles.



System includes built-in 65-W power supply, 1.44-MB MS-DOS-compatible floppy drive, and 207-MB hard drive—all in a compact 9.6-by-10.4-inch package.

Specifications

Processor	
Performance	11.8 SPECmarks (15.8 MIPS and 1.7 MFLOPS)*
Integer unit	SPARC RISC processor
Floating-point unit	SPARC, IEEE standard 764
Cache	64 KB
Memory	
Type	Sun-4™ MMU
Contexts	8 in hardware
I/O interface	DVMA
Standard RAM	8 MB (1-MB SIMMs)
Expansion RAM	1- or 4-MB SIMMs
Maximum RAM	12 MB (with 1-MB SIMMs); 24 MB (with 4-MB SIMMs); 48 MB (with 12 4-MB SIMMs)
Ethernet Interface	
Media type	Coaxial cable
Data rate	10 Mb/sec
Connector	15 pin
SCSI Interface	
Connector	SCSI-2
Serial I/O	
I/O ports (asynchronous)	Two (DIN-8) RS-423 serial (RS-232C-compatible standard)
Audio	8 KHz, 8 bits with low-pulse code modulation; internal speaker
System Bus	
Type	SBus
Address bus width	32 bits
Data bus width	32 bits
Number of slots	Two (support masters or slaves)
Internal Storage	
Floppy disk drive	MS-DOS compatible, 3.5 in., 1.44 MB/720 KB
Hard disk drive:	
Format	3.5-in. disk
Formatted capacity	207 MB
Average seek time	16 msec
Burst transfer rate (synchronous)	4.0 MB/sec
Raw disk data rate	1.6 MB/sec
Desktop Storage Packs	
Hard disk drive:	
Format	3.5-in. disk
Formatted capacity	207 MB
Average seek time	16 msec
Burst transfer rate (synchronous)	4.0 MB/sec
Raw disk data rate	1.6 MB/sec
Tape drive:	
Format	.25-in. tape, QIC-150
Formatted capacity	150 MB
Format	5.25-in. CD-ROM
Formatted capacity	Up to 644 MB
Burst transfer rate	1.2 MB/sec

External Storage Modules	
Format	5.25-in. disk
Formatted capacity	669 MB
Average seek time	16 msec
Burst transfer rate (synchronous)	4.0 MB/sec
Raw disk data rate	1.8 MB/sec
Drives supported	1 or 2
Format	8-mm, helical scan tape
Formatted capacity	2.3 GB
Format	.25-in. tape, QIC-150
Formatted capacity	150 MB
Monitor Options	
Resolution	1152 (h) × 900 (v) pixels
Dots per inch	100 (16 in.); 84 (19 in.)
Pixel aspect ratio	1:1
Antiglare treatment	AR coated panel (19 in.); Fine silica (16 in.)
Connector, power supply	13W3, 100-120/ 200-240 VAC, autoranging
16-in. color (aperture grill)	
Refresh rate/dot clock	76 or 66 Hz, noninterlaced/ 106 MHz
Controls	Brightness, contrast, power, vertical centering, overscan, horizontal and vertical static convergence
19-in. color (shadow mask)	
Refresh rate/dot clock	66 Hz, noninterlaced/93 MHz
Controls	Brightness, contrast, power, degauss
19-in. monochrome	
Refresh rate/dot clock	76 Hz, noninterlaced/ 106 MHz
Controls	Brightness, contrast, power, vertical and horizontal centering, overscan
Keyboard	107 keys, low profile
Mouse	Optical, 3-button
Software	
Operating system	SunOS 4.0.3 or higher
Window system	OpenWindows, SunView™
User interface	OPEN LOOK graphical user interface for OpenWindows DeskSet environment
Networking (standard)	ONC, Ethernet, NFS,® TCP/IP
(optional)	SunLink,® Sitka,™ SNA, SunNet™ Manager, SunNet License
Language options	C, Pascal, Modula-2, FORTRAN, Sun Common Lisp, COBOL
Graphics libraries	SunVision, SunPHIGS, XGL, SunGKS, Xlib, PostScript, Pixwin

Environment	
Operating temperature	0°C to 40°C (32°F to 104°F)
Nonoperating temperature	– 20°C to 60°C (– 4°F to 140°F)
Operating humidity	20% to 80%, noncondensing @ 40°C
Nonoperating humidity	95%, noncondensing @ 40°C
Operating acoustic noise	5.17 bels
Nonoperating acoustic noise	4.93 bels
Noise power emission level per ANSI Std. S12.10-1985	
Regulations	
Meets or exceeds the following requirements:	
Safety	UL 478/UL 1950, CSA C22.2 no. 950-M89, TUV EN 60950
RFI/EMI	FCC Part 15, DOC, VCCI, VDE 0871
X-ray emissions	DHHS 21 CFR, Subchapter J; PTB German X-ray Decree
Static discharge	15 KV—no hard errors
Electrical	
AC voltage	100-120 VAC or 200-240 VAC
AC frequency	47-63 Hz
System power supply	65 W
Power input without monitor	42 W (.72 amps 120 VAC); 143 BTU/hr 44 W (.54 amps 22 VAC); 150 BTU/hr
Power input with 16-in. color monitor	160 W (2.16 amps @ 120 VAC); 546 BTU/hr
Dimensions and Weights	
SPARCstation IPC Chassis	
Height	11.7 cm (4.6 in.)
Width	24.4 cm (9.6 in.)
Depth	26.4 cm (10.4 in.)
Net weight (with internal disk)	5.45 kg (12 lbs.)
Monitors	
19-in. color (shadow mask)	
Height	44.2 cm (17.4 in.)
Width	46.7 cm (18.4 in.)
Depth	52.3 cm (20.6 in.)
Shipping weight	37.1 kg (81.5 lbs.)
16-in. color (aperture grill)	
Height	41.6 cm (16.4 in.)
Width	40.6 cm (16.0 in.)
Depth	45.3 cm (17.8 in.)
Shipping weight	27.3 kg (60.0 lbs.)
19-in. monochrome	
Height	45.0 cm (17.7 in.)
Width	46.0 cm (18.1 in.)
Depth	41.0 cm (16.1 in.)
Shipping weight	27.7 kg (61.0 lbs.)

* Figures based on the latest release of the SPARCompiler™ family (Sun C 1.1 and Sun FORTRAN 1.4) The SPEC benchmark suite is comprised of ten common application tests of CPU performance, including both integer and floating point. Results are listed in SPECmarks, which is a geometric mean of these benchmarks.

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FORMS, JOBS, ACTIVITIES GENERATED

Other than the day to day calls for help with hardware & software problems a number of other requests are received in the form of written, oral, project generated, system generated or time & data generated tasks or routines.

A number of oral requests have to be placed in writing for security purposes. Written requests are first validated for authenticity and then the nature of the request is determined. After any necessary action has been taken the document (memo, form or other), are filed in the relevant folder.
The following is a list of the different types of request that occur on a regular / periodic basis:-

Parameter Pack Modifications

- A form called a PARAMPACK MOD SHEET is used which specifies the system to be changed (indicated with a unique 4 character field) and a key field (any combination of alpha-numerics), corresponding to lines within the parampack that are to be modified, deleted, or inserted. This is followed by a text field of upto 80 characters representing the new (inserted/modified) entry, followed by the corresponding operation (delete, add, modify).

- This simple job is performed by experienced Technical Support staff. It involves executing the PARAMPACK modification program called: **PARAM.CLI** on each of the DG computers... HOSTB, HOSTD, HOSTE, HOSTG & HOSTH.

- Summary: Parampack is a DG database of records of parameter information used by various company application programs. For example, one aspect of the Purchasing system involves printing out 'purchase orders' with the 'buyers' name & telephone extension number on. This information is 'looked up' by the program by first reading the initials of the buyer who is logged onto the purchase system (connected via a DG VDU) and then using this as a 'key field' to cross-reference the Parameter list of names and telephone numbers etc.

- The memo / form is created or signed as ok by system analysts or programmers responsible for the system in question. This form is generated in response to a user request (manager of a department eg. Purchasing) indicating a change to their requirements such as a new member of staff joining or leaving the company.

Preditor Modifications

- A memo is used to specify changes to the 'security logon' system. Access to an application system on the DG is via 2 levels of logon. First the user log's on to the DG computer by entering a USERNAME & PASSWORD. Second he/she enters their DEPARTMENT name; INITIALS and PASSWORD. Then the user selects the system they wish to access eg. 'Purchasing enquiry', 'Purchase Ordering' etc. Access to a particular system is only permitted if the users DEPT., INITIALS, & PASSWORD all match up with each other (as specified within PREDITOR, a list of users for a particular DEPT.). After this cross-reference is satisfied the correct program is automatically selected for execution, (depending on user the same program can be executed in different ways, depending on the level of security granted).

- Therefore this memo is used to specify the addition / deletion / modification of a new user or system. The memo will specify a number of attributes such as the users name, telephone number, Department, initials, system names that the user is associated with and the program names and corresponding switches.

- This job is performed by experienced Technical Support staff. The program on the DG that is executed is: PRED/S

- The memo is generated & signed by systems analysts or project leaders in response to user requirements. These requirements are put in a memo & signed by a departmental manager when either a member of his staff joins (or leaves) the department / company and needs (or not) access to a number of systems.

- Passwords to these systems and initials are initially set by Technical Support when adding the initials to the system. On the first logon the user is forced to change his/her password (6+ alpha-numeric characters). There is no easy way to enquiry on a users password, therefore if he/she forgets it they ring Technical Support who after validating the caller can change it, and the cycle starts again.

- The process of changing a password is very simple but tediously occurs regularly. As long as the caller can identify himself fully by specifying his name, telephone number, initials, and department and these cross-check with that displayed on enquiry with PREDITOR then the password will be changed to allow access.

Program Implementation Sheets

- A program implementation sheet is used to specify new program executable and source code requirements

- After the application department have finished developing a program they fill in one of these sheets to request its installation. This consists of moving the executable and source from the programmers directory to the ':PROG' (executable directory) on the appropriate DG computer. (The idea of moving their source code is so that when required back only one copy is available at any one time, thus avoiding the possibility of different versions of the same program being generated).

- Technical support receive these forms and run a program called 'BEMARCSET' which prompts for the programmers USER NAME, PROGRAM NAME, and OPERATION (install, overwrite, delete, or recover for modification). A batch job is submitted automatically which implements the supplied changes overnight (at a time when no batch jobs or users are on the system).

- The program implementation form is submitted by programmers / analysts ad-hoc.

Batch Jobs

- These are background overnight jobs. Details of a particular program that is to be 'batched up' are required. These include which

  - databases it uses;
  - whether it needs exclusive access;
  - what it does;
  - what printouts are generated & required by whom;
  - estimate of total run time.

- The implementation of this request is performed by Technical Support in accordance with the automated batch system (which the author designed).

- This request is in response to ad-hoc print file requests; solving problems with other systems; regular periodic date based jobs; and new jobs.

Invoices

If details of a particular purchase for goods / services associated with computer resources department is not clear, such as the purchase order number etc., then the person originally responsible for the purchase will deal with it. The manager of computer resources keeps a manual record of various invoices passed by the department in order to answer future queries and to keep track of money spent / committed for budgetary purposes.

The invoices are also a source of information to confirm commencement dates for various services such as maintenance of hardware and also to check that the expiry date has not been overrun.

Problems with clearing invoices are compounded if details of the purchase have not been kept. Also chasing orders is made difficult.
Delivered items are not easily installed or located correctly if they can not be matched with the project which requested them. This leads onto un-fair treatment to users / departments who may have been waiting the longest for a particular item, a PC say, and then someone else gets it ahead of him.

This manual system is tedious, untimely, and inaccurate.

Hardware Requests

This request comes in many different guises:

- specifying modifications
- request for investigation & solution into a problem area
- detailing problems
- detailing future requests & enhancements
- request for additional hardware

If the request is significant in terms of money, size & complexity, interaction with other systems, time, people, or company policy then the request will have to be authorised by the originating departmental manager and delivered to Computer Resources manager who will accept / reject the proposal. After acceptance relevant staff, Technical Support say, will investigate the real needs / requirements of the area concerned. After analysis and in line with company policy a hardware & software specification will be submitted for costing and a capital authority for money to be raised to cover the cost.

Software Requests

The routine followed for these types of request are the same as for hardware above.

Both hardware and software requests are dealt with by Computer Resources on either an ad-hoc, project generated, system generated or direct request basis. The volume & frequency of these types of request are the most significant, in that there are many regular requests and each generates a lot of paperwork (documentation, purchase details, maintenance details, configuration and installation planning data), and as such tight control and management of them must be maintained.

There are many other miscellaneous requests as briefly discussed below:

Outgoing Requests

There are many various requests, such as rasing an order for a specified item eg. hardware, software etc.

This type of request requires a degree of interaction between the purchasing systems and help desk system in terms of delivery time information regrading a departmental project say.

Reprints

- This involves queuing up to print, files that were generated by previous batch jobs say.
- This is in response to a user who wants another copy for various reasons.

Performance Figures

- This job is performed by Technical support and involves visiting the computer / area under observation and running monitor programs and observe for as long as is necessary. Very time consuming.

Library File Updates

- Performed by Technical support in response to memos from the programming department.

There are many other miscellaneous jobs during which problems can occur which can be tedious and time consuming but very necessary to solve such as:

- memos which are not signed or authorised
- memos which do not have all the necessary details
- memos which have incorrect information on

- Informing relevant people on completion of a job
- filing memos
- Handling enquiries concerning memos
- Retrieving memos

In response to these problems it requires someone to contact the originator of the memo to obtain the correct information. This itself can be fraught with problems when the originator is not available (phone busy, not in etc.). In this eventuality the memo has to be put to one side and try again later. This too is error prone in that the memo may be mislaid or forgotten. Thus, any further enquiries regarding this memo may discover that it can not be found unless it was refiled correctly on the previous occasion.

Another problem is that if the memo is addressed incorrectly or inconsistently then members of Technical support may be unaware of previous related memos.

These problems can cause time delays and a poor image, in-efficiency of resources through confusion, incorrect or poor service or results.

These problems can be solved through the Help Desk which can manage, coordinate, validate and check memos for completeness, consistency and accuracy. At a latter stage may even deal with the memo requests themselves.

LITERATURE REVIEW

The author during the course of this project made good use of a great number of books, as indicated in Appendix G. In particular, in terms of implementation, the SQL*forms reference manuals supplied by ORACLE Corporation were of great benefit. The author had absolutely no experience of SQL*forms before the commencement of this project but after reading each and every SQL*forms manual from front to back on numerous occasions and coupled with many a happy hour in front of his computer has learnt a great deal (as one would hope!) and feels that he is now in a position to comment on the usefulness of these manuals and other books.

The SQL*forms manuals as just mentioned were relatively easy to follow and built up a very impressive picture of what SQL*forms were capable of. However, due to a lack of resources (a computer & Oracle RDBMS) I was not able to practice that I had just learnt. As most experienced programmers will appreciate, it is almost impossible to learn new languages or other computer systems without actually being able to sit in front of the system as they learn it. All credit is due to Oracle in producing such good manuals in that I learnt a great deal from just reading them. However, on receipt of my computer system and RDBMS I realised that I had to refer to the manuals extensively for the simplest things but at least I knew where to look. I would recommend the use of SQL*forms but in conjunction with "hands-on" tuition or after an Oracle course.