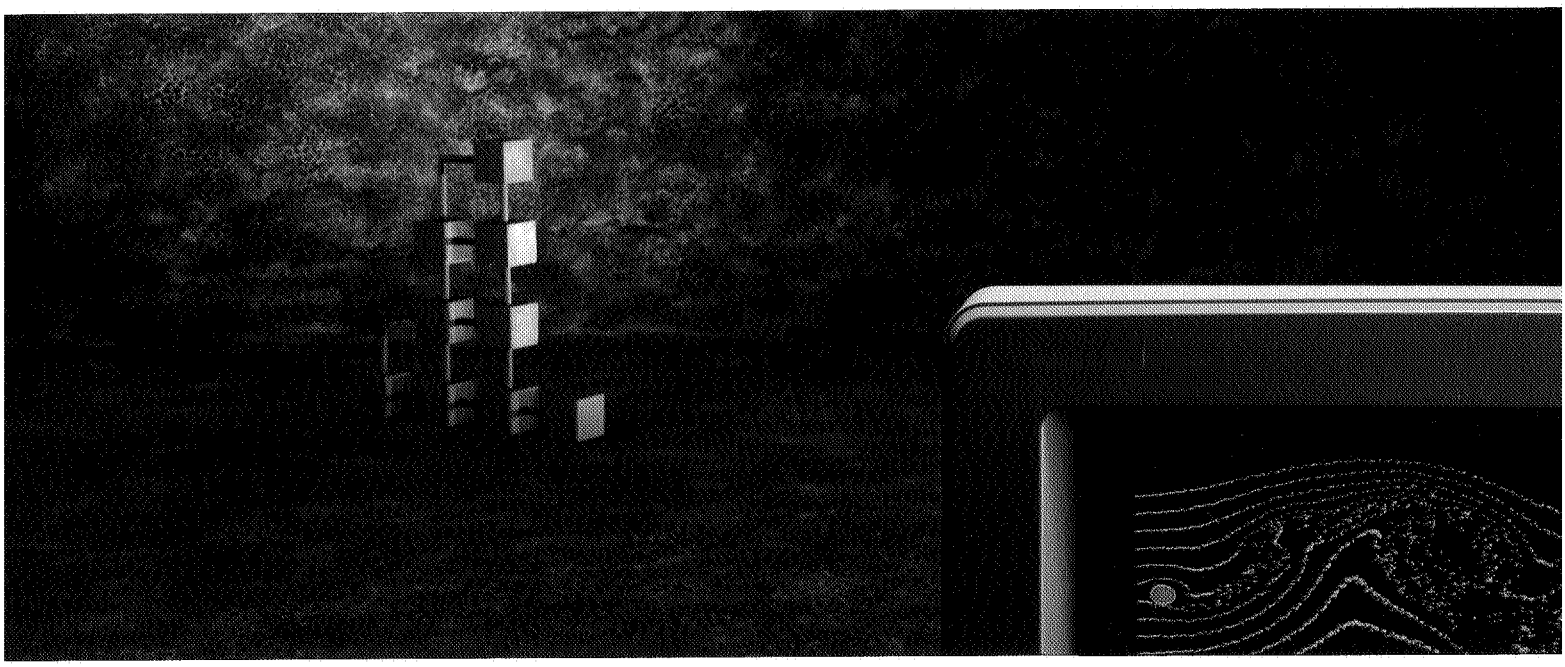
Transputer: Parsys



The PARSYS SuperNode 1000 Series

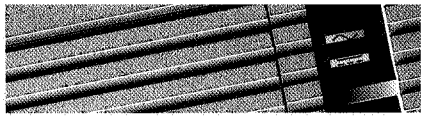
PARSYS offers you
the most cost effective solution
to the computing requirements
of both today and the future.

PARSYS

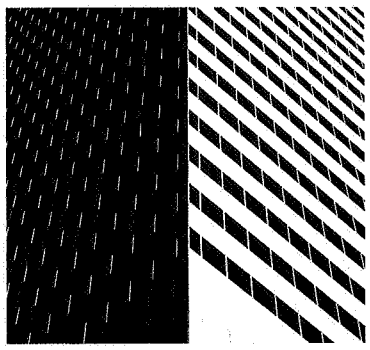
THE COMPANY *PARSYS Ltd. is a member of the THORN EMI Group; a major international corporation. The THORN EMI name is synonymous with success through technical innovation and quality. The PARSYS development team originates from the THORN EMI Central Research Laboratories; an establishment made world famous over more than 50 years by its pioneering work in high technology.*

The SuperNode 1000 Series Research and Development team was formed at the THORN EMI Central Research Laboratories during a European Commission funded ESPRIT project. A total of 150 man years of effort was directed at the development of the PARSYS architecture whose systems now deliver personal workstation through to supercomputer performance. The fundamental building block of the architecture is the INMOS T800 Floating Point Transputer which was designed as part of the project and is now the flagship of the INMOS range.

The PARSYS SuperNode 1000 Series is engineered, manufactured and maintained by highly experienced divisions of THORN EMI plc.



Many industrial and commercial professionals have computing applications which require unlimited amounts of computational power. If you are running a word processor or small accounts package then your personal computer should have enough power. If you are trying to access a large database, perform engineering analysis or use many other modern applications then the chances are that your computer is either underpowered or too costly, probably both. Parallel processing is the state of the art computer technology whose cost effectiveness makes even the latest conventional machines obsolete.



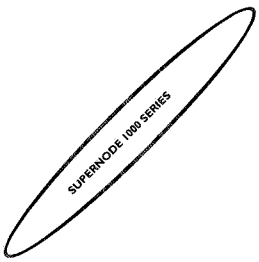
PARSYS Ltd. is committed to providing high performance parallel processing systems which are extremely cost effective, easy to use and readily upgradeable as requirements increase. This is achieved through the use of an innovative computer architecture that supports international software standards. The architecture can be easily tailored to a particular application through exploitation of its modularity, flexibility and a wide range of integrated peripherals. PARSYS systems can operate in a typical office environment just like a personal computer or workstation.

The PARSYS open systems philosophy enables existing applications to be easily ported to the machines. The IDRIS operating system provides UNIX compatability with enhancements that significantly improve its real time functionality.

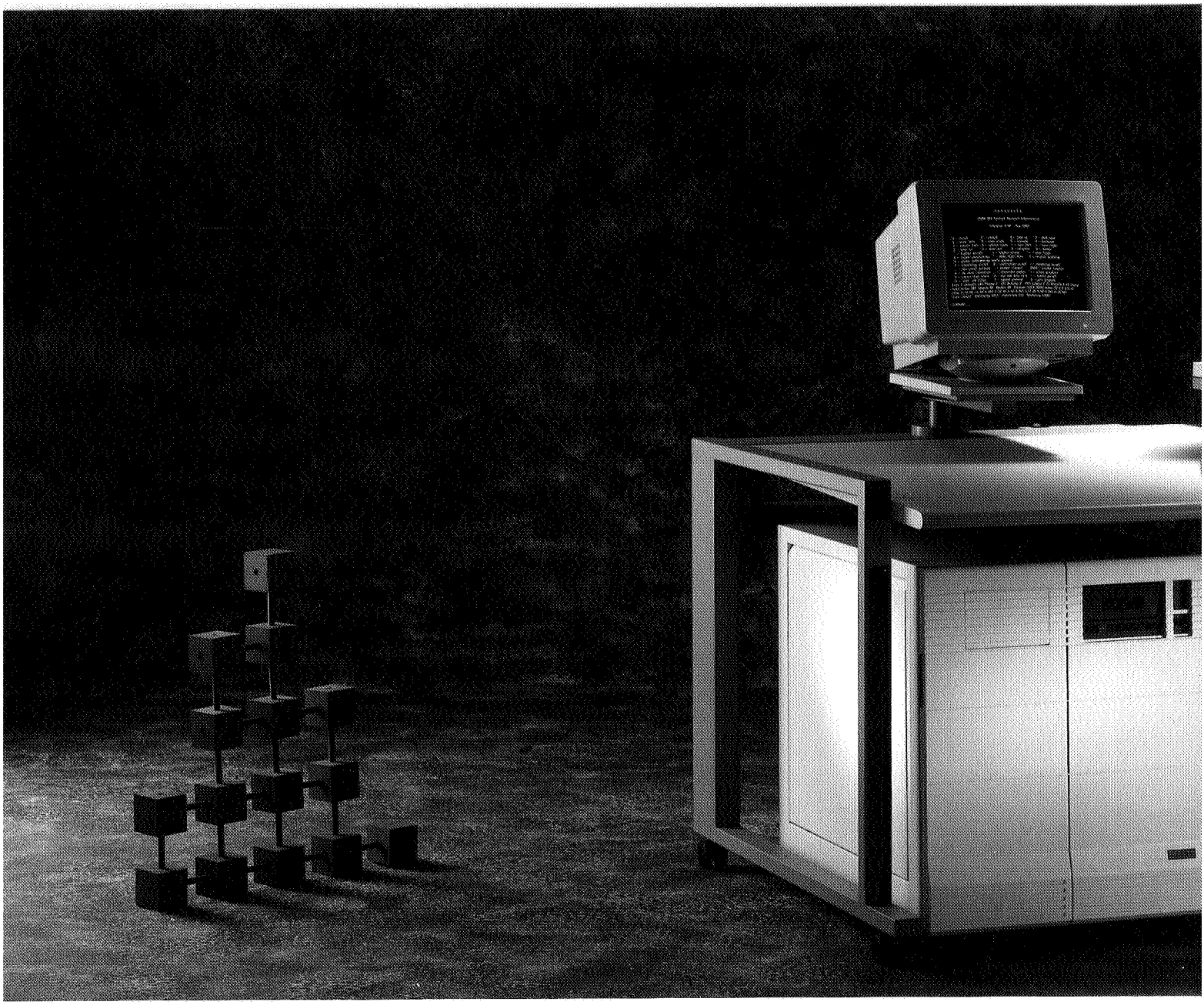
In offering accessible, affordable power the PARSYS SuperNode 1000 Series gives an easy entry into the world of parallelism, and the provision of your future computing needs at the cost-performance

levels which only parallel machines can deliver.

A REVOLUTION IN COST – PERFORMANCE



Cost/Performance of SuperNode 1000 Series compared with traditional machines

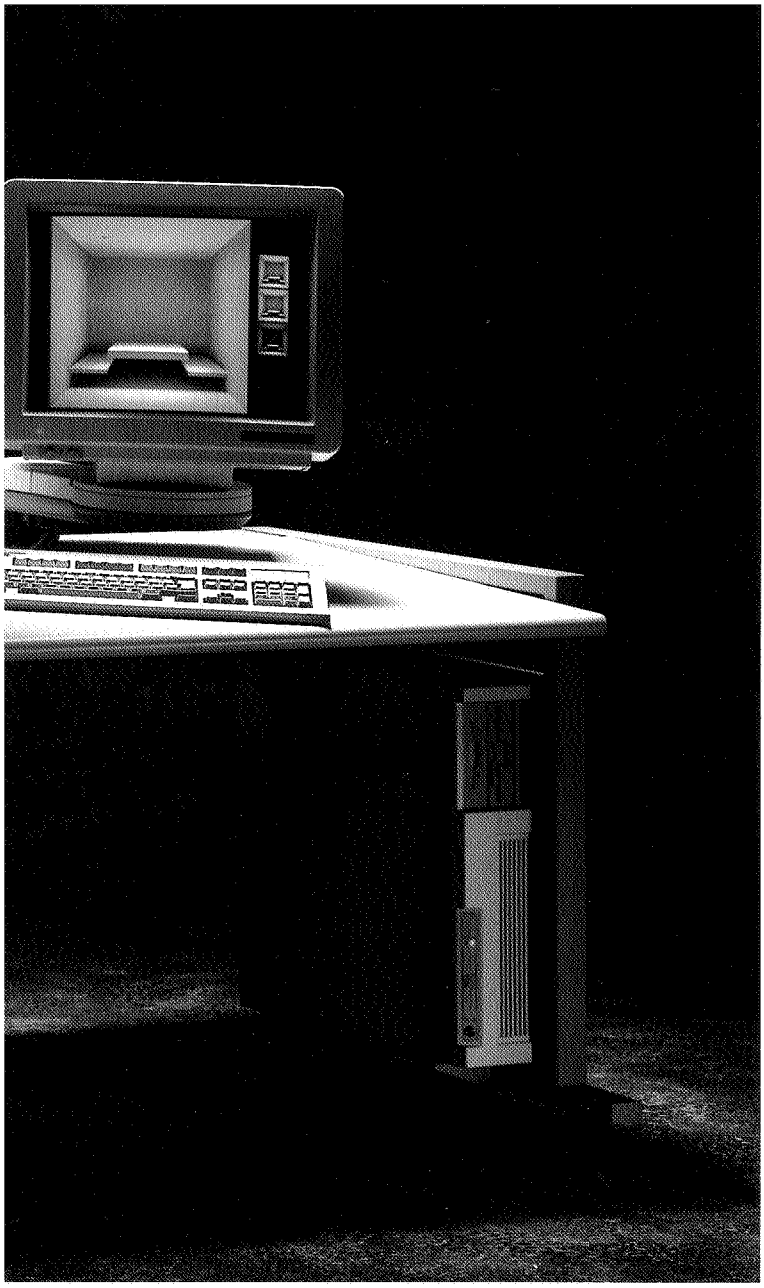


PARALLEL PROCESSING THE WAY FORWARD

Parallel processing is the division of a problem into a number of different parts which can be worked upon simultaneously. This 'division of labour' enables the problem to be solved at greater speed provided the communication of information between the collaborating parts can be achieved efficiently. This balance between computation and communication is the key to solving parallel problems rapidly. When a true balance is achieved the increase in performance over sequential processing can be staggering.

Parallelism is inherent in most natural and scientific problems and yet traditional sequential computers have constrained their solution by using only one processor. The most powerful sequential architecture designs of today are becoming very expensive as they push against the barriers of physics to achieve greater performance. The PARSYS SuperNode 1000 Series offers the user the most advanced transputer based computer systems of today. Parallel processing provides the means of modelling problems naturally and allows many processors of proven silicon technology to be employed simultaneously providing the maximum power at very low cost.

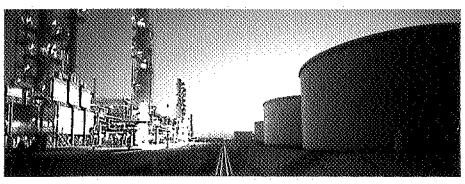
In recent years a number of multi-processor designs have been developed with different approaches to parallel processing. Usually these designs have

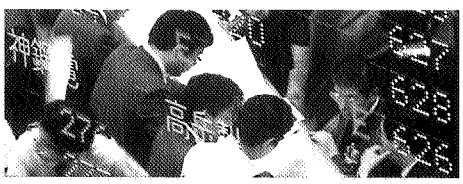


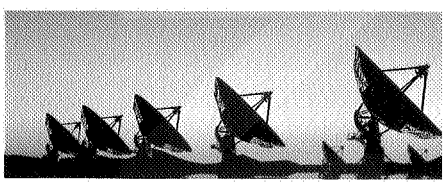
Parallel processing is the state of the art computer technology whose cost effectiveness makes even the latest conventional machines obsolete.

been limited by their communication performance, however some designs have succeeded in providing an effective solution to a restricted set of problems. The development of the transputer by INMOS provided the first general purpose parallel processing chip. The transputer was designed specifically to offer high computing performance with the ability to communicate rapidly with a number of other processors. Its logical simplicity, coupled with a clear balance between computation and communication, means that the transputer offers an inexpensive, but extremely powerful solution to parallel processing.

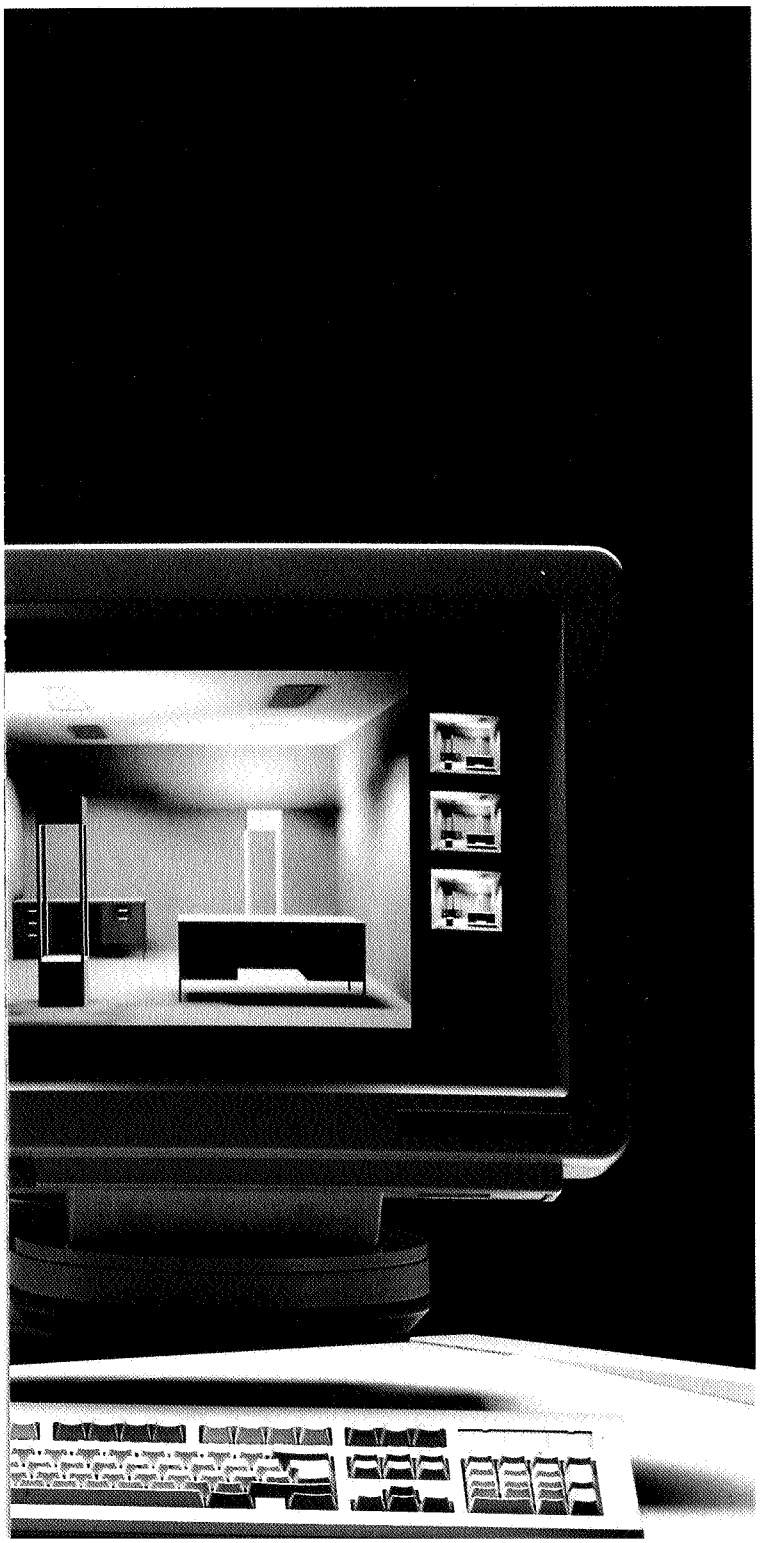
The architecture was designed to exploit the power and flexibility of transputers to the full. The SuperNode is fully reconfigurable over the whole range of machines. This ability to choose a processor configuration well matched to the communications requirements of the problem in hand means that substantially better performance can be realised than with a fixed architecture.







In offering accessible, affordable power the PARSYS SuperNode 1000 series provides cost-performance levels which only parallel machines can deliver.



PARALLEL PROCESSING – THE PARSYS SOLUTION

Parallelism exists naturally in most problems whether of a commercial, scientific or engineering nature. The PARSYS SuperNode 1000 Series can be applied to a vast number of problems in very diverse areas and the solution of these problems can be achieved more rapidly, more cost effectively and more efficiently by the use of PARSYS systems.

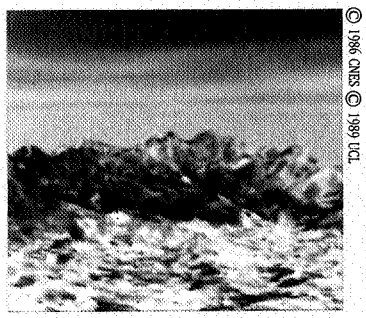
Commercial problems are diverse but are often characterised by the need to have the correct information available, in the correct format as quickly as possible. The modern business uses large amounts of data stored in a structured manner and this must be retrieved selectively and rapidly in order to maintain a competitive edge. This is increasingly achieved using a database system that requires massive storage and extensive computing power.

PARSYS is in partnership with the Oracle Corporation to accelerate the performance of their database software suite and produce a transaction processing machine capable of performance far in excess of conventional processors. ORACLE's advanced distributed architecture is ideally suited to a true parallel implementation; PARSYS systems provide this with parallel disk support that maximises throughput. The ORACLE Database Management System offers a full implementation of SQL, the industry standard relational database language. The ORACLE suite is supported over a broad range of machines and operating systems; this means that ORACLE applications developed on conventional computers are easily ported to the PARSYS implementation.

Engineering applications that are inherently parallel in nature include computational fluid dynamics (CFD) and finite element analysis (FEA). CFD techniques use complex simulations to determine the flow characteristics of mechanical fluids or gases. FEA of its very nature is parallel, as an object is subdivided into many small elements that can be worked upon individually.

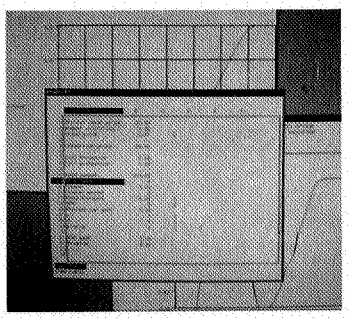
PARSYS is working closely with FEGS Ltd., acknowledged experts in sophisticated graphics systems for finite element analysis, to produce an extremely efficient FEA machine. Field Analysis Modeller (FAM) from FEGS Ltd is a suite of computer programs for modelling the behaviour of structures under load. FAM is widely recognised as providing state of the art pre and post processing for all the major finite element analysis programs on the market. The FEA solver program of the FAM suite has been ported to PARSYS systems and great increases in performance have been achieved over conventional computers. The major proprietary FEA software packages can be substantially accelerated by using PARSYS systems.

Scientific applications that can benefit from the power of the SuperNode 1000 Series are numerous, but include molecular modelling, nuclear physics and geophysical mapping using seismic data. Signal processing and image processing are areas where the very fast I/O capabilities of the SuperNode 1000 series can be readily applied.



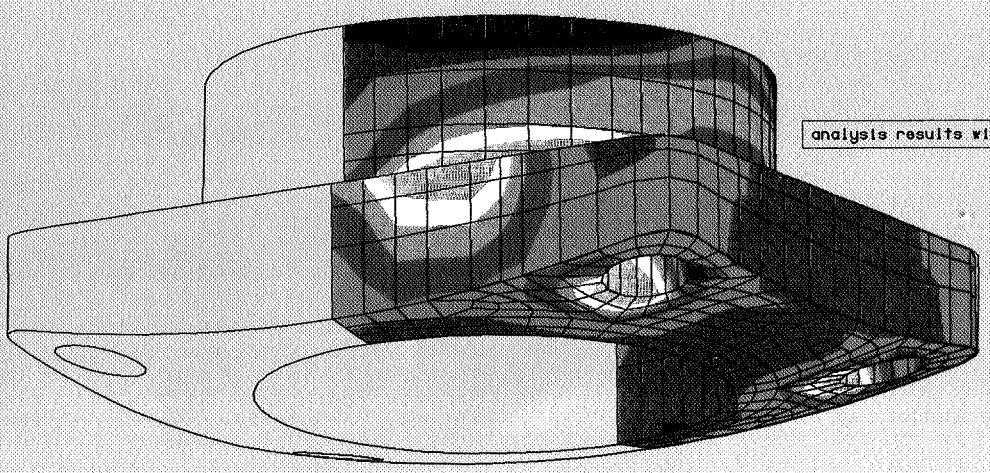
The automatic generation of highly accurate digital maps from satellite data is typical of an application made computationally viable by using the cost performance advantages of a PARSYS system. In turn this has helped to nurture new applications in the civil and military sectors that require digitally mapped data.

Simulation and visualisation techniques are increasingly used in many areas of design and manufacture. One area that is being very successfully addressed by PARSYS equipment is the modelling of lighting using radiosity techniques. THORN Lighting is using this technique to evaluate new lighting schemes through visualisation of room and building layouts.

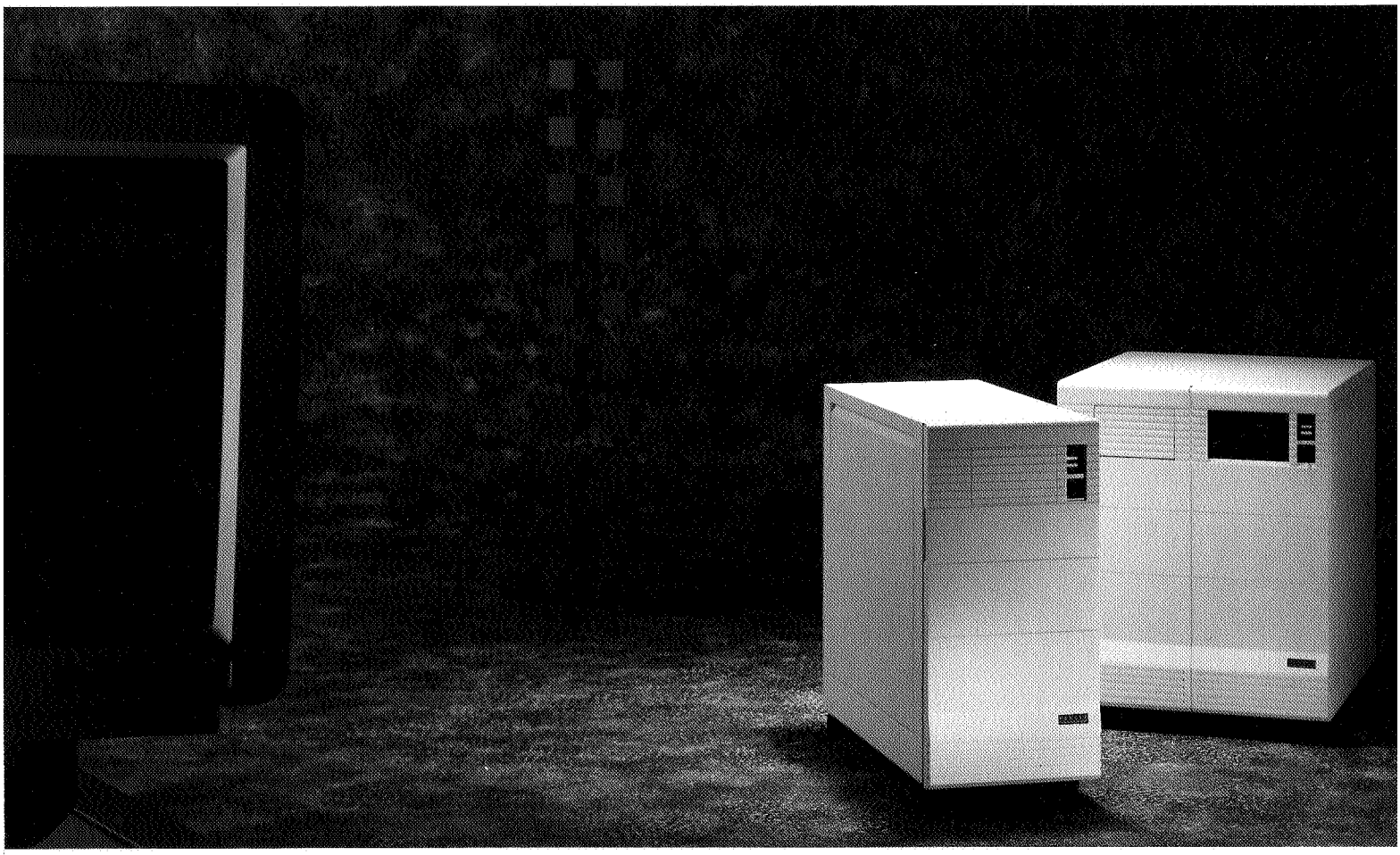


The financial world revolves around the need for rapid response to requests for data. This invariably means that communication and computation times have to be reduced in order to give a competitive edge. Complex financial modelling techniques are being used increasingly to provide decision support. These techniques are ideally suited to the SuperNode 1000 Series.

PARSYS offer you the most cost effective solution to both today's applications and those of the future with a range of systems that provide maximum scaleable power with extensive peripheral support.



The PARSYS SuperNode 1000 series can be applied to a vast number of problems in very diverse market sectors.



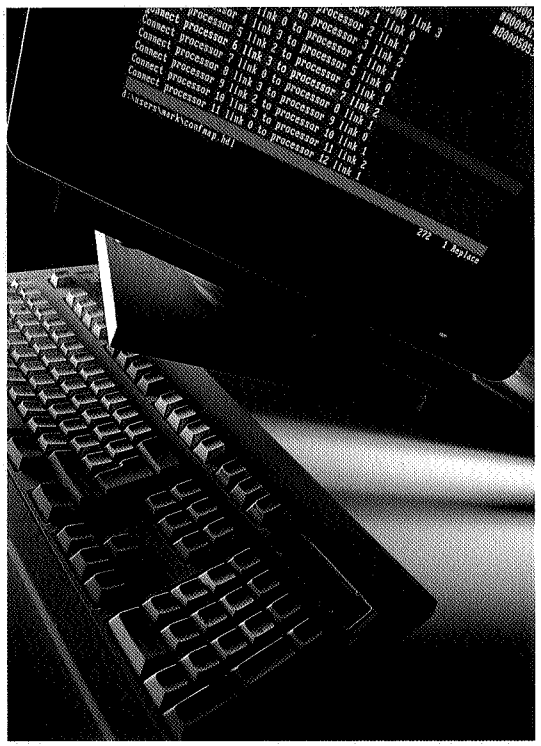
SYSTEM SOFTWARE SUPPORT

The PARSYS system software strategy is to provide the user with software that adheres to internationally recognised standards. PARSYS is a member of X/Open and provides an operating system with a POSIX conformant programming interface. Language compilers conform to ANSI and ISO standards wherever possible. In pursuing the goal of portable code PARSYS is also committed to providing optimum usage of the power and flexibility of the Transputer.

IDRIS Operating System

The SuperNode 1000 Series is provided with IDRIS, which is a POSIX conformant, UNIX compatible operating environment. The IDRIS operating environment consists of a multi-user, multi-tasking executive plus an extensive set of utilities including many especially developed for the SuperNode 1000 Series. In addition to the standard range of features, the SuperNode 1000 Series implementation also supports parallel execution of IDRIS programs by separate worker transputers. The support for the POSIX programming interface on worker transputers significantly enhances the portability of software products onto the system.

In addition to the basic IDRIS package, a host support package is supplied in order to provide an interface between the SuperNode 1000 Series and the host computer. The primary function of this package is to provide host device access including local and remote terminals and disk access. The host support package also provides a convenient mechanism for direct communication between user processes running under IDRIS and the host operating system. For the SUN workstation this consists of a SUN device driver for the SUN VME interface and a multi-threaded program used to access host devices as well as import/export utilities for transferring files in and out of the IDRIS filing system. The filing system operates very efficiently by using an internal SCSI disk system and SCSI tape streamer for backup. Alternatively the host's mass storage facilities may be used if required.



X Windows

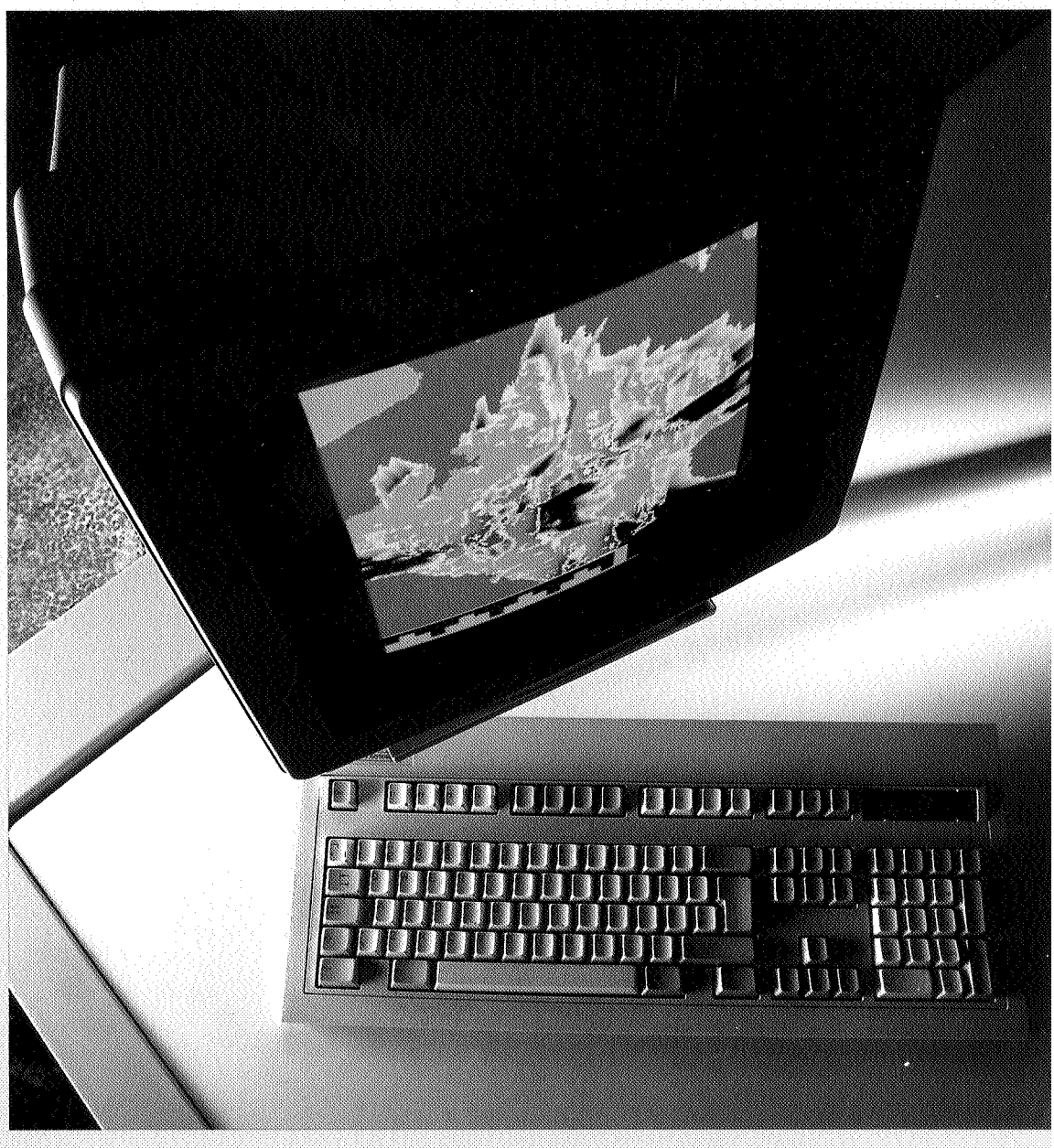
SuperNode 1000 Series systems hosted from SUN workstations support X Windows; the recognised de facto standard in windowing systems. X Lib support is given across the processor network to host or external X servers.

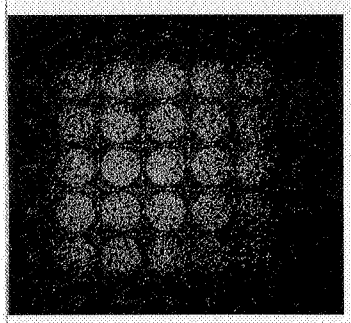
PARSYS Enhanced Transputer Development System

The SuperNode 1000 Series may also be used for the development of embedded applications using the PARSYS enhanced version of the INMOS TDS. This is based upon the current (D700D) version of TDS and provides standard OCCAM support. The enhancements include multi-user support and automatic configuration of the SuperNode from TDS 'wiring diagram' files. A full run time breakpoint and continue debugger has been implemented for the OCCAM language using the facilities of the SuperNode Control Bus.

Languages and Libraries

The IDRIS operating system is delivered with ANSI C and ISO Pascal compilers as standard and an ANSI standard Fortran compiler is also supported. Parallel compilers are available from 3L for C, Pascal and Fortran. In addition PARSYS offer vector and serial numeric procedure libraries callable from OCCAM and all languages running under IDRIS. These libraries are coded in transputer assembler, where necessary, and make use of fast internal RAM to increase performance over standard compiled code. System calls specific to the SuperNode 1000 Series enable allocation of internal RAM, and with the advent of the T801, allocation of fast external RAM also, enhancing the performance of user code even further.





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THE SUPERNODE 1000 SERIES ARCHITECTURE

The SuperNode is based upon the concept of reconfigurable computer architectures, that is to say architectures which can be altered to suit the problem at hand. Because different problems require different processor topologies, changing the configuration of the machine must be simple, efficient and quick. The SuperNode 1000 series architecture enables *any* network of transputers to be created and configured, dynamically if required. This offers the user the potential to apply different architectures to different parts of the problem. In turn, this enables the full performance of the machine to be realised over a wide variety of problems.

The PARSYS SuperNode 1000 series architecture and the INMOS T800 transputer were designed together during the ESPRIT SuperNode project. In brief, transputer modules are organised into groups of 16 processors, termed nodes, which can be linked together in a highly flexible manner to configure large systems of up to 64 nodes. The primary architectural advantage is that it allows large, completely reconfigurable systems to be constructed with minimal communication bandwidth penalties.

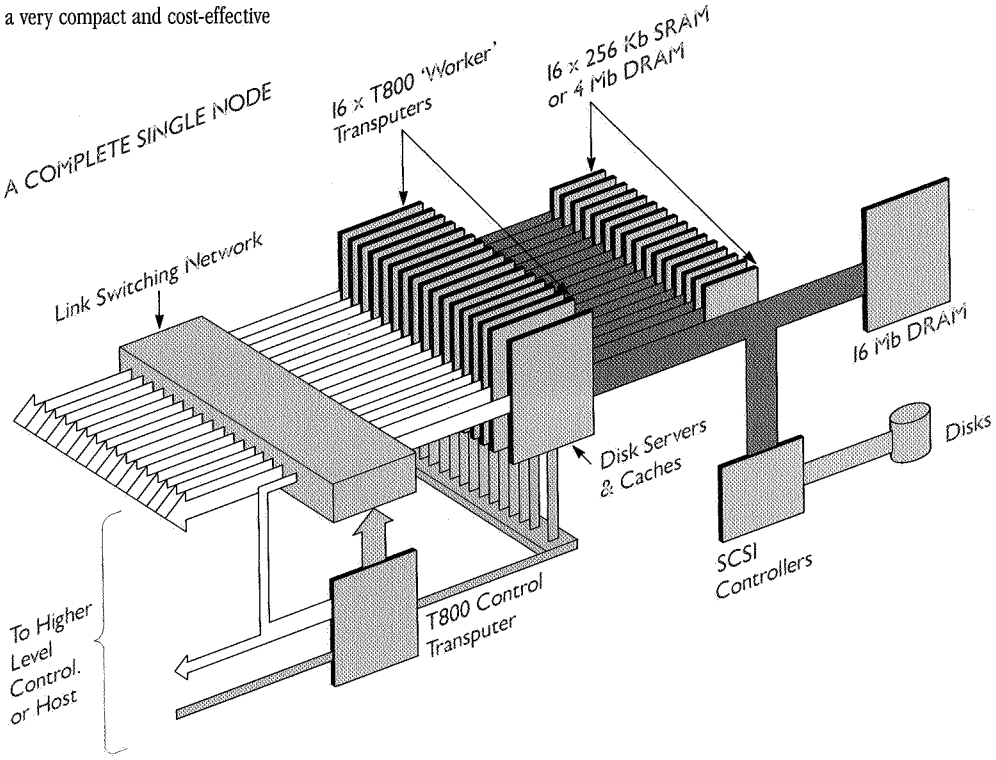
A SuperNode-specific switch was designed which realises the full potential of the T800 transputer links without the penalties introduced in similar systems. This single level switch will support up to 72 transputers directly. Larger systems of up to 1024 "worker" transputers use a second "outer" level of switching which requires traversal of a maximum of 3 switching elements along *any* communication path. This approach is hierarchical: at any architectural level the machine can be viewed as a switch connecting nodes together, where a node is a transputer, at the next level a SuperNode and so on.

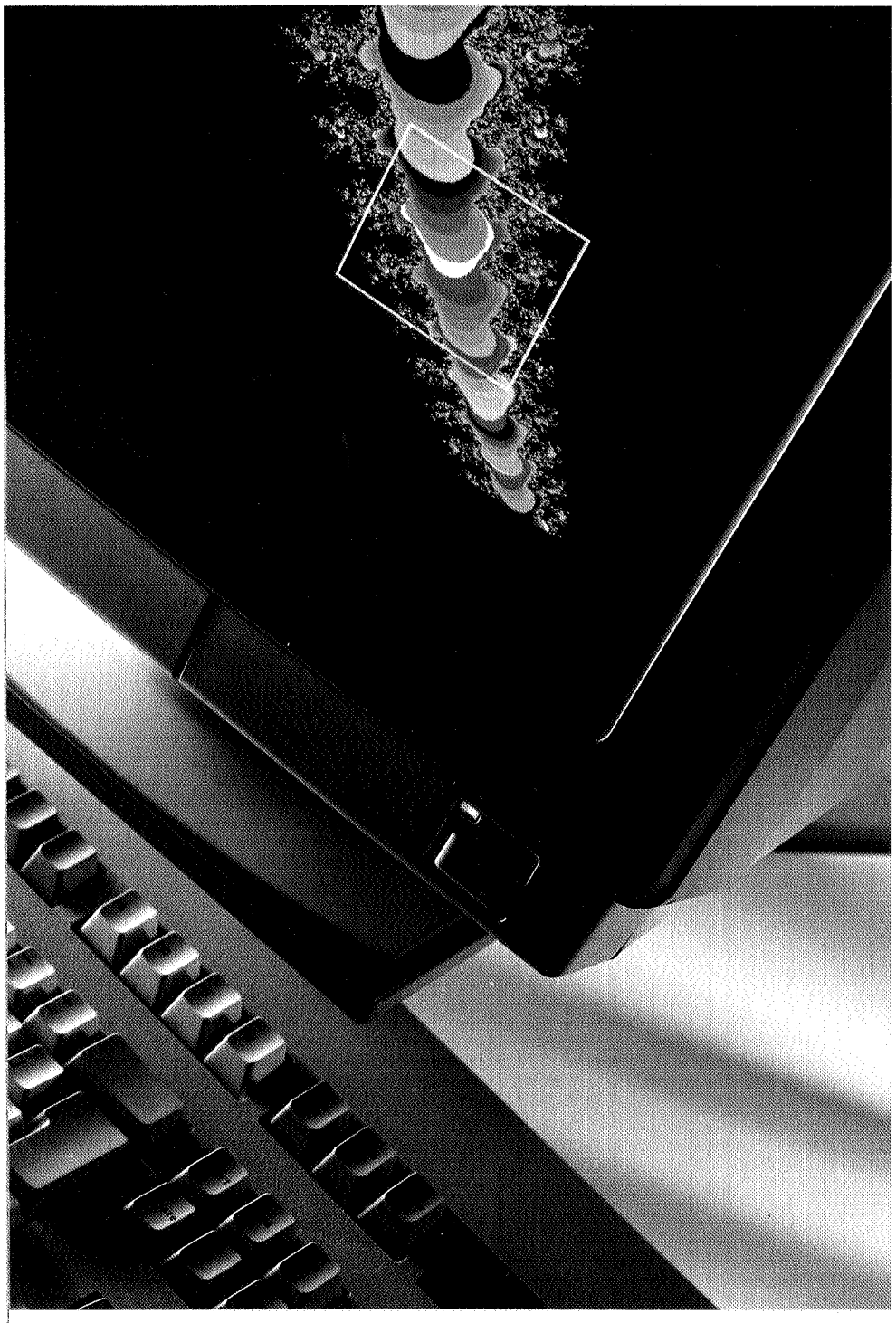
The basic architecture of each SuperNode is a group of "worker" transputers providing the basic computational resource with support transputers which handle I/O and control functions e.g. reconfiguration, disk access, display functions. In a minimal, single node configuration there are sixteen worker transputers, each with associated local memory, and a control transputer. The control transputer has 512 Kbytes of local RAM and provides access to the software programmable SuperNode link switch and other external communication ports (e.g. RS232). There is a Control Bus which is accessible by all transputers, and can be used for link independent debugging, synchronisation and system control functions.

A single SuperNode can be *extended* to double the number of "worker" transputers (up to 32) supported by the backplane switch. In addition two SuperNodes may be closely coupled to realise an alternative configuration known as a "tandem node". This configuration uses only the basic SuperNode switch, maintains full reconfigurability and supports up to 64 worker transputers in a very compact and cost-effective package. This system offers over 100 MFlops in a standard 19 inch rack mount, 16 inches high.

Large systems are constructed using the basic SuperNode as building blocks and are connected by the second "outer" level switching hardware. These systems typically comprise 128, 256, 512 or 1024 workers. Associated with the hierarchical link switching is a corresponding hierarchical Control Bus which provides a global control facility in the same manner as is provided within a single SuperNode. It is important to note that with this switching architecture the time required to communicate between neighbouring nodes is the same as between the extremes of a 64 node system. As a result, the design permits the full computational power and reconfigurability of the basic node architecture described earlier to be maintained across the full range of available systems.

The full reconfigurability of the PARSYS architecture coupled with optimal communication bandwidth capabilities distinguish the systems from all others on the market.





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WORKER AND SUBSYSTEM OPTIONS

PARSYS offer a number of worker module options and a wide variety of flexible subsystems including memory servers, disk servers, display subsystems, framestores, fast input/output engines and host interface cards.

Worker Module Specification and Options

The basic processing capability of a SuperNode is the "worker" module. Each module is a self-contained processing element with T800 transputer, local memory and slave control bus interface. Worker modules are grouped into boards of eight on a mothercard, and connected to the SuperNode switch. A worker module may be supplied with 256 Kbytes of SRAM or alternatively 4 Mbytes or 16 Mbytes of DRAM. PARSYS are also committed to supporting the latest processors available from INMOS.

Memory Server Specification and Options

Memory server configurations consist of a single IMS T800 transputer with currently up to 96 Mbytes of local DRAM (parity protected), 128 Kbytes of EPROM and slave Control Bus interface. Various memory speed options are also available. The current maximum memory bandwidth is 25 Mbytes per second using a T800-25 transputer and 4 cycle DRAM.

Disk Server Specification and Options

Disk server configurations provide all the features of a memory server, and in addition a high performance SCSI interface and optional floppy disk interface. For the SCSI interface, PARSYS now use one of the latest very high performance SCSI protocol controllers which operates largely independently of the transputer, requiring minimal intervention. It can sustain 5 Mbyte/second transfers with SCSI devices in synchronous mode and data can be transferred to or from the transputer's memory space at a burst rate of 20 Mbytes/second. As with all PARSYS hardware extensive test features are built in to ensure rapid identification and accurate location of faults.

SCSI devices currently supported include a wide range of disk storage capacities from 155 Mbytes to over 1GB, ½ inch GCR tape drives and 8 mm cartridge tape streamers. Disks and cartridge tape streamers can be mounted internally in the SuperNode cabinet or, for larger configurations, externally when used in conjunction with the SNDS 1800 range of disk subsystems. The SNDS 1800 provides the capability to configure multiple external subsystems with disk capacities of up to 5GB per subsystem.

All these SCSI features are fully supported by the IDRIS operating system.

Display Subsystem Specification and Options

Six different display subsystem configurations are available using from one to four IMS T800 transputers each of which has a memory mapped framestore partition. A close coupling between the problem solving system and the display is achieved by direct connection of display transputer links to the SuperNode switch. Each of the display transputers has up to 1 Mb of SRAM for program storage, up to 4 Mb of VRAM and a full Control Bus slave interface for close integration into the SuperNode architecture. The top of the range configuration gives a displayable resolution of 1280 × 1024 pixels arranged as a window onto a virtual resolution of 2048 × 1024 pixels, with two frame buffers each 32 bits deep. This configuration is driven by four transputers allowing all 16 links to be dedicated to the transfer of display commands.

All systems in the range support flash fill functionality and an extensive range of masking functions. With each pixel represented by 32 bits an extensive 16 million colours may be potentially displayed with additional sophisticated colour overlay modes. A single, user-definable, 64 × 64 pixel cursor and cross-hair are supported by the hardware over the whole area of the screen or a windowed portion of the display. Interlaced or non-interlaced modes can be generated with complete control over sync generation. The display subsystem may also be locked to an external sync source.

There are three software interfaces to the display subsystems. Direct access to the hardware may be made for full flexibility or use may be made of a graphics primitive library to provide a higher level of support. The Graphics Kernel System (GKS) is currently being ported onto the system, with an X Windows server planned.

Interface Specification and Options

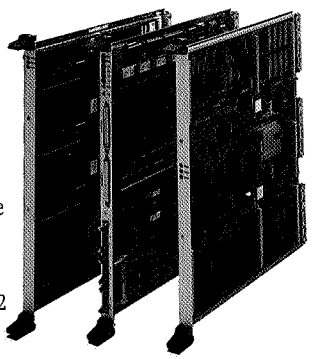
The SN1000 series may be hosted from a SUN workstation or IBM PC.

For SUN workstations a SuperNode-specific interface card is available which resides in the SUN backplane. This card provides the following features: T800-20 transputer, 4 Mbytes local DRAM (parity protected), 128 Kbytes EPROM, 128 Kbytes fast dual ported SRAM, 4 INMOS links for communication with SN1000 series hardware, full SuperNode Control Bus interfaces, fast input/output port and full VME master and slave facilities. The master interface provides access directly to all VME addresses and can achieve high bandwidth data transfers (exceeding 10 Mbytes/s) directly to VME devices. The dual ported SRAM, with appropriate hardware byte swapping, is used for efficient synchronisation between the SUN and transputer card for master-slave data transfers.

Use of the master-slave capabilities of the SUN VME interface card provides a very well integrated and efficient coupling between the SUN and the SuperNode. In turn, this permits the IDRIS operating system to be closely integrated with the SUN environment.

The host interface for the IBM PC or compatible currently uses industry standard transputer cards inserted in the PC. This provides transputer-based link communication between the PC and the SuperNode.

An Ethernet interface with NFS support is also under development allowing the SuperNode to be integrated into a local area network.



Framegrabber Specification

The framegrabber provides a framestore that is controlled by a single T800-20 transputer which interfaces directly to the rest of the system by its serial links. The standard input interface is for black and white video; 625 lines at 50 Hz with a 512 square frame size. Custom designs for non-standard input devices can be undertaken.

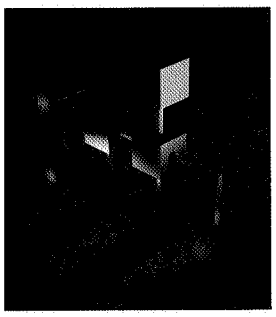
Fast Input/Output Specification

The fast input/output cards provide a versatile interface between external parallel data streams and transputer links. A powerful control system is used to allow high speed external data streams to be distributed right into the heart of the SuperNode for efficient processing of the data. Such systems are ideal for applications such as real-time data processing.

QUALITY AND CUSTOMER SUPPORT

PARSYS is committed to maintaining high levels of quality in its hardware, software and customer support. PARSYS pre and post sales support means that your organisation is assured of our total commitment throughout the lifecycle of your installation:

- ☐ PARSYS' sales staff, or those of our Distributors, will discuss your requirements in both hardware and software in order to provide the configuration best suited to your needs.
- ☐ PARSYS' production and internal quality procedures mean that you are assured of the highest standards of manufacture and reliability. Our rigorous customer acceptance programme guarantees you of this.
- ☐ PARSYS thoroughly screens its Approved Maintenance Organisations to ensure that your equipment will be maintained at the very high standards which PARSYS set and that you – the customer receive the service you demand.
- ☐ PARSYS' programme of Software Development and User Support ensures that your system can enjoy the benefits of both current and future innovations in software.
- ☐ PARSYS offer a variety of tailored training courses and consultancy covering all aspects of the SuperNode 1000 series as applied to your problems.



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THORN EMI

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