Take a closer look at

supermax

-the Great Danes

Danish
Design
& Quality

dde

supermax

highlights

(handwritten notes in top margin):
- Hvordan behandles Unix III & [68000]
  i.f.t. System V & [68020?]
- Brochurens "præsentation" — forside & tekst?
  (Skal "ny" brochure behandles alene el.
  som en fortsættelse? — Fortsættelse kræver
  anden indledning).

Introducing Supermax

Supermax® is a multi-CPU computer series based on an ingenious application of modern microprocessor technology. Powerful enough to compete with main frames and 32 bit super minis, Supermax has a price at the level of a "super-micro". It is an ideal vehicle in which OEMs, distributors, and systems integrators can come to market quickly and profitably. Because,

Supermax is more than a "super-micro"

Concurrent multi-CPU operation gives linear performance increases when adding CPUs.

Multiple Applications Processors

Powerful:
- 1-8 CPUs, MC68000 12.5Mz
- 1-8 Mips performance
- CPU Cache, Disk Cache
- Broad bandwidth buses
- Intelligent I/O controllers

(handwritten): ? CPU el. MPU?

Highly Expandable:
- Modular construction
- Up to 128 users
- 512K byte – 128M byte main memory
- 20M byte – more than 10G byte disk

Reliable:
- Standard ECC on main memories
- Parity-protected local memories
- Remote diagnostics

Future-secure:
- Modular construction allows easy upgrade
- Supports 16/32 bit and true 32 bit CPUs concurrently
- 32 data bit architecture

Multi-user/real-time operating system:
- UNIX™ System III implementation
- Berkeley enhancements
- Bell-Licensed UNIX System III tools including Shell
- Pascal, C, RM and Micro Focus COBOL, SVS Fortran, and SMC Basic
- Oracle Relational DBMS
- Multi-CPU support
- Dynamic work load allocation.

concept

very powerful, reliable, and flexible computer system based on state-of-the-art microprocessor technology.

This technology made it possible to design and produce a computer system, that in its basic configuration, is more powerful, but price competitive with a "super-micro". Enhanced Supermaxs compete in performance, but at a much lower price, with traditional 32 bit minicomputers and smaller main frames. Supermax, though, is not a traditional micro or mini.

Office Automation Requirements – Unpredictable

Supermax is designed for an uncertain future, where almost all requirements are vague, except one:

There is a constant need for MORE,

- Work stations
- Working memory
- Disk memory
- Processing power

Future Assured – Expandability

Our experiences show that computer systems are expanded more quickly, both in size and workload, than planned at purchase time. This observation is especially true for the office automation market, where many requirements are as yet unspecified.

Supermax is therefore constructed to be expandable to a much higher degree than other computer systems. Upgrade is easy.

The user can ADD:

- CPUs for more processing power.
- Processing power can be increased not just by 30 or 50%, but by as much as 700%.
- Memory modules for more program and data space.
- I/O controllers to expand the number of work stations and/ or disk storage, and give access to communications and networks.

The Future is Unforgiving

The last decade's rapid technological advances have made the job of the system constructor difficult. Investments made today must be justifiable tomorrow. Prolonged consideration or in-house development can delay market entry and lose market share, which is just as deadly as an incorrect product decision.

Designed to Take the Risk Out

Supermax is the result of a strategy to build and market an easily expandable,

Competitiveness Assured – Price/ Performance

Supermax can be tailored exactly to user requirements. Each additional CPU increases the Supermax's total processing power with all of the power of the add-on CPU. The CPUs operate concurrently, and each CPU accesses its own memory on its own memory bus. The operating system also helps out by distributing load to the processor best able to support it.

The Common Bus is used only for I/O and inter-CPU communication, and is dimensioned to support large data transports at high speed. This means that increases in processing power are not limited by an overloaded bus, nor do CPUs stumble over each other to access a common memory via a single bus.

Investment Assured – Software Compatibility

A major design criteria for Supermax has been software compatibility. We have satisfied this demand at two levels.

In order to ease your entry into the market, we have implemented UNIX System III. It supports, of course, multi-CPUs, and for extra flexibility, and as a guarantee of compatibility, we offer Bell-licensed UNIX tools and Shell. Use of this de facto standard gives access to a large and growing number of third-party UNIX languages and software packages.

Further, all Supermax systems, from the smallest 1 CPU system, to the largest with 8, use the same operating system. This means

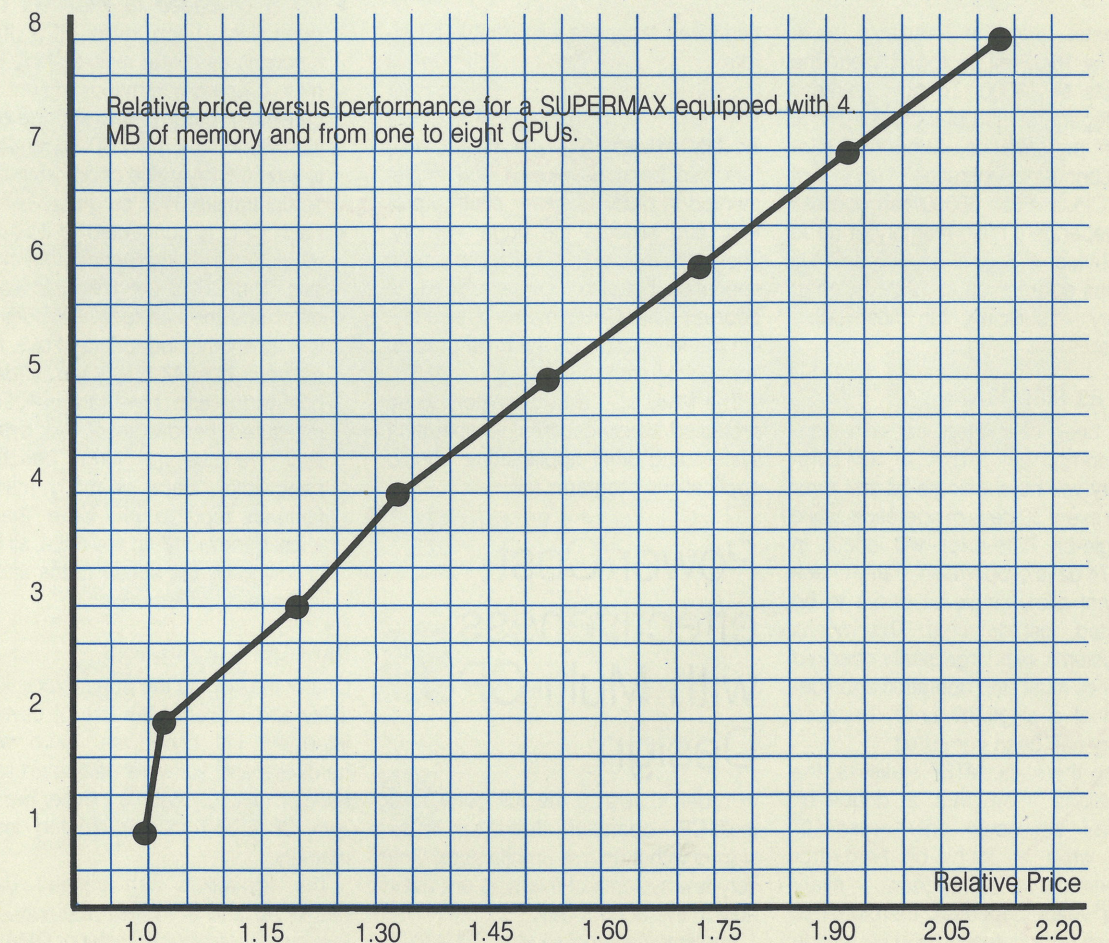expansion requires absolutely no change in applications software.

Longevity Assured – 32 Bit Architecture

Supermax is designed and constructed as a 32 bit computer. Its data and memory buses are 32 data bits wide. Its memory is organized in a 32 bit structure, and high speed I/O is blocked to 32 bits by the intelligent I/O controllers. It currently uses a 16/32 bit CPU, the Motorola MC68000, running at 12.5 Mhz, and using an onboard cache.

Nothing in the Supermax is CPU-dependent – neither software nor hardware. Supermax will become a true 32 bit computer as soon as these CPUs and their auxiliary chips become a stable market factor. 32 bit CPUs, such as the 68020, can be implemented along side of existing 16 bit CPUs.

And, again, the software remains the same.

Performance in Mips

Relative price versus performance for a SUPERMAX equipped with 4 MB of memory and from one to eight CPUs.

Relative Price

hardware

have not realized the full benefits of multi-CPU operation because of three limiting factors:

- Memory was expensive, therefore every CPU shared the same main memory. The result was the CPUs had to wait for each other to fetch and store, thus degrading total system performance.
- I/O was handled directly by the main CPU(s); an inordinate amount of processor time was, and is used for "byte-banging". I/O can be offloaded to intelligent front- and back-ends, and expensive solution up until now.
- Channel bandwidth was insufficient to support the I/O generated by the many applications. Of course, more bandwidth could always be purchased.

Leading-edge Technology Bursts Traditional Constraints

- Memory is now inexpensive, and will continue to fall in price. Supermax therefore uses direct instead of virtual memory. *Each CPU has its own main memory*, up to 16M bytes.
- *I/O is off-loaded to intelligent I/O-controllers*. Each main CPU thus functions as a true multi-tasking engine. It issues commands to subprocessors in order to talk with the outside world. The main CPUs continue to execute main-line code, while the actual transfer is in progress.
- Each CPU is connected to its main memory by an *independent memory bus*. The CPUs are linked to each other and the intelligent I/O controllers by another independent bus, the *common bus*. All buses are 32 data bits wide, and have an effective, measured bandwidth of 4M bytes/sec. We use the term "effective bandwidth", because many manufacturers report a very large "theoretical bandwidth". In any case, all I/O is limited by the speed of the sending/receiving memories.

Intelligent controllers

One of the keys to the Supermax's flexibility and power is the use of several intelligent I/O controllers, each with hardware and software dedicated to a specific function. Each controller has its own CPU and parity-protected local memory.

The controllers can transfer data directly to and from main memory, either by programmed transfer or DMA on a cycle-stealing basis – the main CPU need not be involved.

Power and Memory Space with Multiple CPU Design

Supermax uses the industry's most powerful 16/32 bit microprocessor, the Motorola MC68000. To give an easy and elegant method of increasing total system performance, Supermax supports concurrent operation of up to 8 of these CPUs. Each 68000 can address an independent main memory of up to 16 M bytes. A Supermax with 8 CPUs can thus address up to 128M bytes of memory – sufficient for most applications.

ECC as standard

It has been calculated that with standard component MTBF, a 16M byte-memory will have a single-bit soft-error during every 30 days of operation, while a single-bit hard-error will occur in every 74 days of operation. Parity check does not allow single-bit errors to be corrected, just detected. This means that systems with large parity-checked memories must stop operation upon detection of a single-bit error, because memory has been corrupted.

Using the same MTBF statistics, the calculations show that a double-bit soft-error will occur only every 10^9 years, while a double-bit hard-error happens much more often – every 3.8×10^5 years. Supermax, therefore has standard error detection and correction (ECC) on all main memories. The ECC corrects single-bit errors, and allows a controlled response with double-bit errors.

MMU

An MMU (Memory Management Unit) has also been developed and implemented in order to better control, protect, and allocate the huge memory. The MMU not only provides program relocation, but also allows each CPU to address other CPU's memory, thus laying the foundation for the multi-processor environment.

The MMU also allows memory to be protected, which secures the operating system and other applications, should applications programs fail.

Power/Cost-effectiveness with Multi-CPU Design

In order to realize the full benefits of multi-CPU operation, Supermax is designed with a unique architecture. Only very few systems of this type are available in the world today.

Implementation of several CPUs to increase computer throughput is not a new technique. Previous architectures

Some of the controllers available are:

SIOC – Serial Input Output Controller
Supports eight serial devices: terminals, printers, modems, in RS 232C/V.24 mode. Two of the ports can support RS 422a/ V.11 mode. In addition to the serial ports, the SIOC has a parallel port for high speed printers.

DIOC – Disk Input Output Controller
Supports 5 1/4" or 8" floppy, 5 1/4" or 8" SCSI or SMD Winchesters. Each DIOC supports a streaming tape unit for Winchester backup. The DIOC can also support 9 track NRZI/PE IBM compatible tape drives. Overlapped seek supported by two or more DIOCs.

NIOC – Network Input Output Controller
Provides link to Supermax LAN using Ethernet[tm] standard.

CIOC – Communications Input Output Controller
Supports 2 independent communications ports running in asynchronous, synchronous, SNA/SDLC, HDLC, or X.21/X.25 modes at speeds of up to 64 K bits/sec.

Reliability

Supermax has been designed to give an excellent reliability and ease of maintenance that match stringent OEM requirements.

Each intelligent module in the Supermax has an independent I/O port dedicated to diagnostic use. These RS232 ports make it possible to diagnose hardware failures, even while the Supermax is running. The diagnostics can be made remotely via a modem and telephone line.
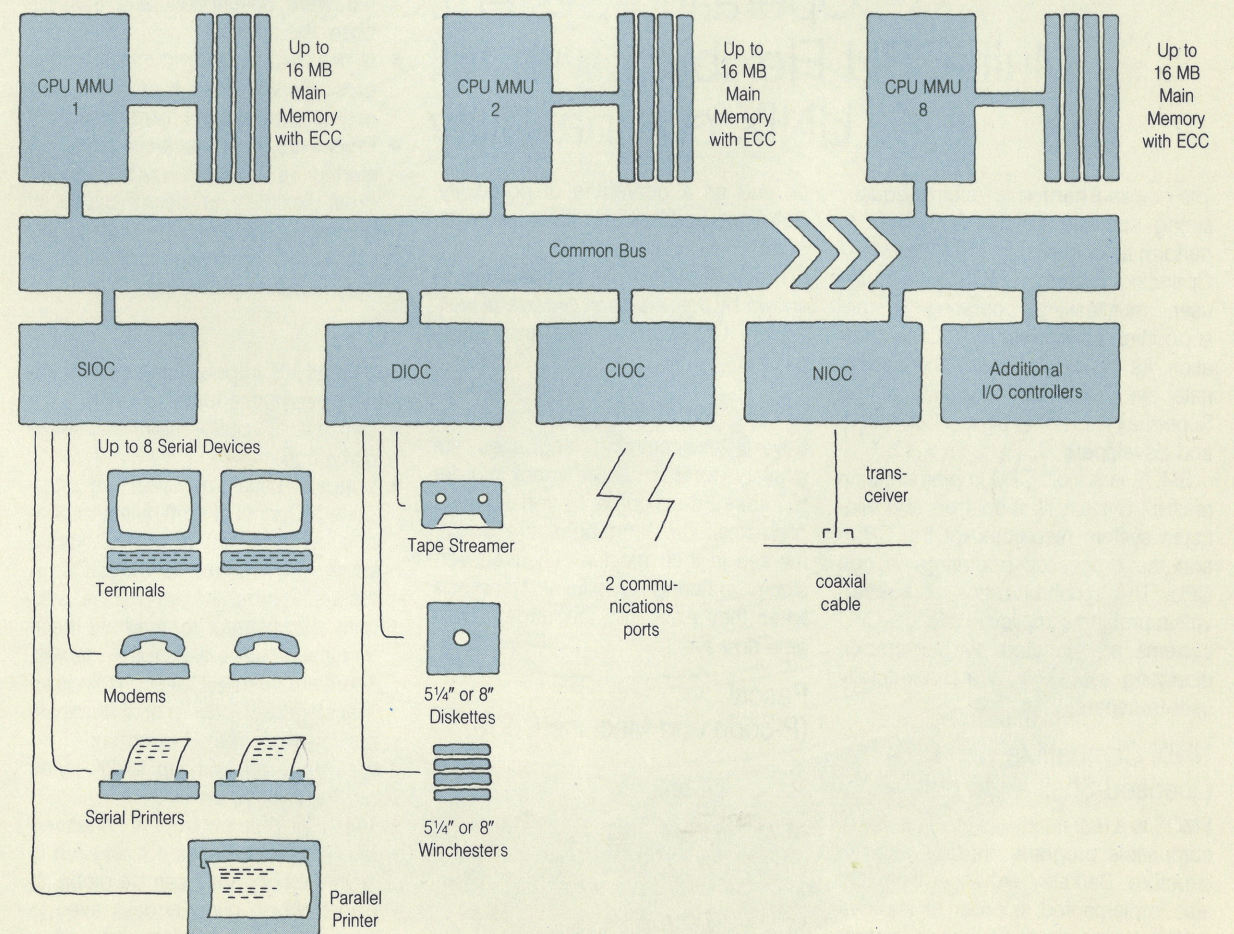
Basic Configuration

The Multi-CPU Supermax basic configuration consists of a 12-slot chassis with six slots occupied:
- Two CPU/MMU modules
- Two 512K byte 150 NS RAM with ECC
- One SIOC 8 port module
- One DIOC disk interface module

Expansions

Memory modules can be expanded in increments of 512K byte to 1M byte per module or of 1M byte up to 4M byte per module.

A 12-slot expansion chassis is available giving expansion possibilities to a total of 24 slots.

CPU MMU 1 — Up to 16 MB Main Memory with ECC
CPU MMU 2 — Up to 16 MB Main Memory with ECC
CPU MMU 8 — Up to 16 MB Main Memory with ECC
Common Bus
SIOC — DIOC — CIOC — NIOC — Additional I/O controllers
Up to 8 Serial Devices
Terminals
Modems
Serial Printers
Parallel Printer
Tape Streamer
5 1/4" or 8" Diskettes
5 1/4" or 8" Winchesters
2 communications ports
transceiver
coaxial cable

software

Advanced Facilities

In addition to standard UNIX III facilities, the SMOS has been enriched by several functions which better utilize Supermax's unique concept.

Memory Control

The system uses the features in the Supermax MMU to allocate and control main memory, giving both economical and rapid access.
- Shared program code optimizes memory use. Only one copy of each program is necessary for multi-user use.
- Data can also be shared between several processes.
- User applications can be controlled from corrupting each other and the operating system.

SMOS enhancements
- Both record and file locking are implemented in the multi-CPU environment.
- Swapping facilities are standard in SMOS. The system automatically handles environments where applications require more main memory than physically available.
- SMOS is very easy to configure. When the hardware configuration is changed, the system administrator merely runs a conversational program which changes the system hardware description, and then reboots the system.
- Unlike UNIX, an individual subroutine can be invoked as a process, thus restructuring control hierachies.
- Processes in a hierarchy may be started at different nodes, giving great flexibility in determination of process subordination. That is, unlike UNIX, processes can change their monitoring process.

I/O

Supermax I/O capabilities are also improved over those found in UNIX.
- Dynamic I/O buffer lengths optimize disk performance.
- "Virtual" serial devices are supported. Control of terminals and printers is done by a user-definable table, down-loaded to the SIOC. A standard program allows the systems adminstrator to generate these terminal/printer descriptor tables. There are therefore no such things as "nonstandard" ASCII serial terminals and printers on the Supermax.
- Disk blocking, with up to 2K bytes blocks, speeds disk I/O.
- The UNIX pipe concept is enhanced to be a "Box". Boxes not only run in main memory, they can be global in extent, which gives access even to applications executing on other CPUs in the system.

Supermax Operating System: Multi-CPU Flexibility with full UNIX compatibility

The powerful hardware requires equally strong software for the Supermax to perform at its maximum. The Supermax Operating System (SMOS) is a multi-user, multitasking operating system supporting concurrent multi-CPU operation. Its job is to channel and coordinate the power and flexibility of the Supermax in order to benefit both users and developers.

SMOS is a multi-CPU implementation of UNIX System III. It controls and allocates system resources for the CPUs and the processes operating on one CPU. The synchronization and reservation problems implicit in all multi-CPU systems are handled by Supermax's operating system in a manner totally user-transparent.

UNIX Compatible with Bell-Licensed Shell and Tools

SMOS is a real-time system with a UNIX compatible program interface and file structure. Berkeley enhancements are also implemented in order to improve system performance as well as correct minor UNIX deficiencies. It is written in C, and as a guarantee of portability, Bell-licensed Shell and tools are available.

Proof of full UNIX compatibility is shown by the easy port of several well-known UNIX languages and applications.

Language Tools

Several programming languages are available for use with Supermax in order to ease development and porting problems. The languages are implemented in their most widely-used versions, adhering to official standards when they exist. The languages available now are:

Pascal
(P-code and Machine Code)

C

Micro Focus and
RM ANSI COBOL '74

SVS Fortran '77

SMC Basic

Data communication

The Supermax, through its CIOC intelligent I/O controller, supports a broad range of data communications applications. Most of the protocols are executed directly by the controllers, further unloading main CPU (s). The following protocols are available:

Bisynchronous:
- IBM 2780/3780
- IBM 3270 BSC
- UNIVAC UTS-400

SDLC/HDLC:
- IBM 3270 SNA
- IBM 3770
- X.25

Asynchronous:
- TTY emulation
- VT100 emulation

LAN
Based on Ethernet standard

Programming tools

UNIX is widely accepted by EDP professionals because of the ease of application software development given by the system and its many utilities.

Such concepts as pipes and filters significantly increase programmer productivity. The Berkeley enhancements of MAKE, LINT, SCCS, etc simplify source text control. In addition to UNIX's powerful programming tools, Supermax has:

Oracle Relational DBMS

A true relational database using the data manipulation language SQL. Oracle is easy to use because all data handling is done by SQL, even from languages: COBOL, C, and Pascal. Oracle is a perfect tool for prototyping. Database size, tables, and even columns can be changed during normal operation.

Supermax Menu

Provides a standard, menu-driven interface for easy and consistent access to all applications.

ISAM

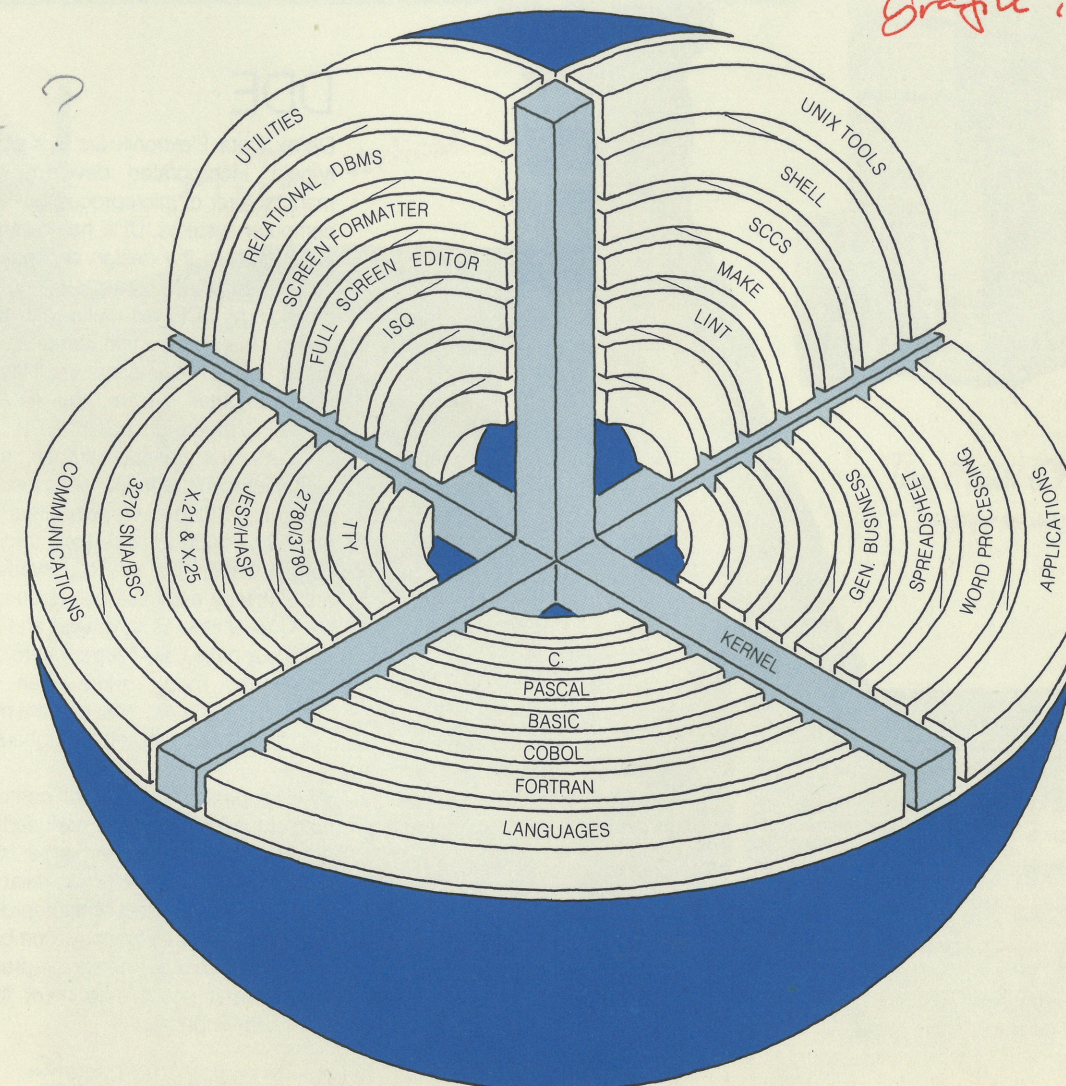Index sequential file handling helps effectuate specialised data bases using C or Pascal.

Screen Format Generator
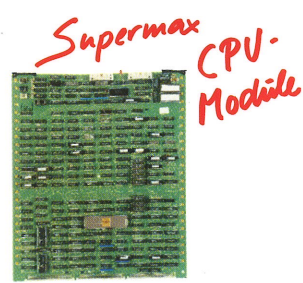
Simplifies development of screen layouts.

Applications packages

A large and growing applications library is available for the Supermax now:
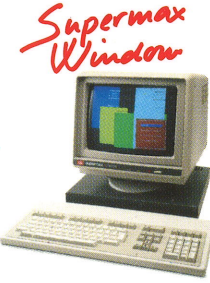- Word processing with text formatting and photo typesetting options.
- General business package with inventory control, order and invoice processing, general ledger, and accounts payable/receivable.
- Easy to use electronic spreadsheet.
- Fully integrated office automation system, which includes the above word processor and `spreadsheet, electronic mail, electronic archive, calendar, document handling, etc.
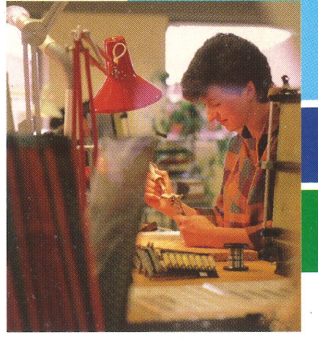

UTILITIES
UNIX TOOLS
RELATIONAL DBMS
SHELL
SCREEN FORMATTER
SCCS
FULL SCREEN EDITOR
MAKE
ISQ
LINT
COMMUNICATIONS
3270 SNA/BSC
X.21 & X.25
JES2/HASP
2780/3780 BSC
TTY
GEN. BUSINESS
SPREADSHEET
WORD PROCESSING
APPLICATIONS
KERNEL
C
PASCAL
BASIC
COBOL
FORTRAN
LANGUAGES

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Supermax CPU-Module

Supermax Window

Danish Design & Quality

dde

supermax

The world of
supermax
-the Great Danes

Supermax 2-CPU-Vertical

Supermax Manufacturing facilities

The Multi CPU -Supermax family

DDE

Dansk Data Elektronik a/s is a public-ly-held, incorporated developer and manufacturer of microprocessor-based computer systems. DDE has extensive experience in the design and production of computer systems using this technology. DDE was founded in 1975, and in 1977 was the first European producer of a multi-user, multitasking microcomputer system, the ID-7000. The SPC/1, introduced in 1979, was Europe's first general-purpose, multi-user microcomputer. DDE has installed more than 3000 microcomputers with more than 8000 work stations throughout the world. This wealth of hardware and software expertise has been combined to enable us to design and produce our multi-CPU "super-micro", the Supermax. Today, more than 500 Supermax systems, most of them multi-CPU have been installed throughout the world.

Developments in the 16 bit computer market have aptly shown the needs for greater processing power, larger memories, more expandability and reliability. The cost effectiveness of microprocessor and memory technology, combined with a sophisticated design approach, has made it possible to meet these goals with Supermax.
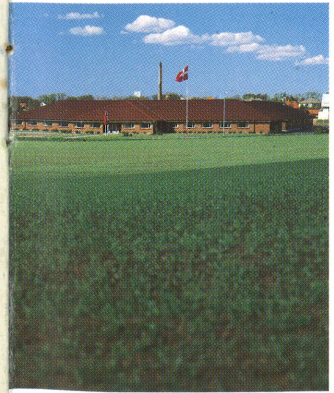
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