sun microsystems, inc.

The Sun-2 Product Family:
A Technical Overview

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Product Description

Sun Workstations® are powerful general-purpose computers providing state-of-the art computing environments for the technical professional. Operating in a distributed network, each workstation supplies its user with a dedicated 32-bit architecture CPU, memory, and a high-resolution bit-mapped graphics display, while using high-speed local area communications to share other network resources and services.

All Sun Workstations run the most advanced version of the UNIX™ operating system, as enhanced at the University of California at Berkeley. UNIX 4.2bsd facilitates implementing and executing technical applications by supporting large demand-paged virtual address spaces, fast I/O to disk and local network, multiprocessing, and flexible inter-process communication.

The Sun-2™ product family comprises several workstations offering the user the identical processing power across a range of flexible configurations and packaging alternatives. The Sun-2/120™ and Sun-2/170 are two members of this family. The Sun-2/120 Deskside™ SunStation™ provides the user with a high-performance personal workstation configured either as an expandable network node or as a self-contained stand-alone system. The Sun-2/170 Rackmountable SunStation provides the user with the maximum configuration flexibility and expandability for building network servers.

In both these systems, fast hardware combines with the power of the UNIX operating system and more than 220 standard UNIX utility programs, plus additional tools such as Sun's multi-window display manager and device-independent graphics library, to create the most productive computing environment available today.

The Sun-2/120 desktop components include the standard 19-inch landscape monochrome display, op-tical mouse, low-profile keyboard, and an optional 13- or 19-inch landscape color display. A separate pedestal unit houses the processor, memory, display electronics, and local network interface, along with options such as mass storage peripherals and color display controller.

The Sun-2/170 enclosure mounts in a standard 19-inch instrumentation rack, and contains he processor, memory, and local network interface. Both monochrome and color displays are available as options, along with several rack-mountable mass storage peripherals offering a wide range of capacity.

Common Features

- 32-bit architecture MC68010 processor
- 16 megabytes of virtual address space per process
- Up to 4 megabytes of physical memory
- Hardware floating point accelerator option
- UNIX operating system supporting demand-paged virtual memory
- Ethernet® local area network interface
- High-resolution (1152 x 900) non-interlaced bit-mapped monochrome display (standard on Sun-2/120, optional on Sun-2/170) with anti-glare option
- Medium-resolution (640 x 480) bit-mapped color display option with 8 color planes (256 simultaneous colors from a palette of over 16 million)
- SunCore™ device-independent graphics library
- SunWindows™ flexible multi-window display manager supporting overlapped windows, pop-up menus, and icons
- C, Fortan, and Pascal programming languages

Sun-2/120 Features

- 9-slot Multibus® card cage (four slots used in basic product)
- One megabyte main memory standard
- Integral disk and tape options for local mass storage
- Attractive office-environment packaging with desktop display unit and electronics in slim-line pedestal
- Ergonomic design with low-profile keyboard, tilt-and-swivel display and optical mouse.

Sun-2/170 Features

- 15-slot Multibus card cage (five slots used in basic product)
- Two megabytes main memory standard
- Packaged for mounting in 19-inch instrument rack
- Large-capacity, rackmountable mass storage options

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Sun-2 Workstation Architecture

The Sun-2 architecture specification standardizes, independently of implementation method, the capabilities of the basic workstation hardware and a common set of input/ output devices that are available to the operating system and to user programs. The architecture supports a multitasking operating system (UNIX 4.2), virtual memory, communications (Ethernet local networking), and bit-mapped graphics displays.

The Sun-2 architecture is based on industry and international standards and was designed for a long, useful lifetime. As the fundamental Sun-2 technologies evolve, advances can be incorporated rapidly into Sun-2 products while maintaining compatibility at the software level. The Sun-2 architecture lends itself to both low-cost and very high-performance implementations. All Sun Workstations in the Sun-2 product family adhere to the architectural specification, providing the user

Sun-2/170

with software portability across a range of workstations with differing features.

Card Cage and Backplane

The design of the Sun-2/120 Deskside SunStation and Sun-2/170 Rackmountable SunStation is based on the industry-standard Multibus (IEEE-796 Bus) for system card cage and backplane. The unique Sun design uses the private bus provided by the Multibus specification (the "P2" bus) for high-speed access to main memory and display memory, while using the basic ("P1") bus as an I/O bus for access to a wide variety of peripherals.

Central Processing Unit

The computational power of all Sun Workstations begins with the most advanced microprocessor available today: the MC68010, a recent addition to the popular Motorola 68000 processor family. This CPU supports virtual memory operation, allowing users to develop application pro-

grams larger than the amount of available main memory without complicated overlay schemes. Every process may use up to 16 megabytes of virtual address space, enough for the most sophisticated technical applications.
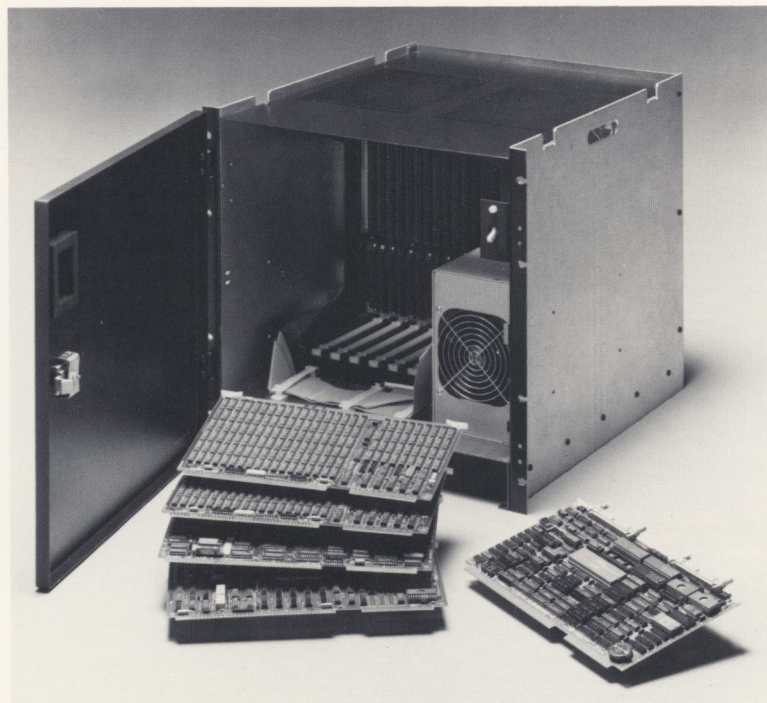
Memory Management Unit

Sun-2 workstations operate the MC68010 processor with a 10 MHz clock. At this high clock rate most microprocessor systems are limited by the speed of their main memory —the CPU must incur one or more
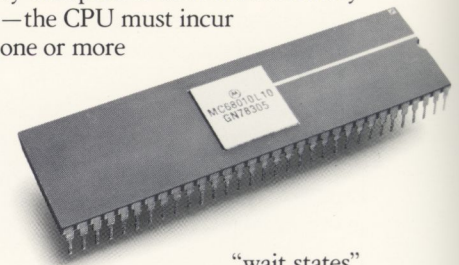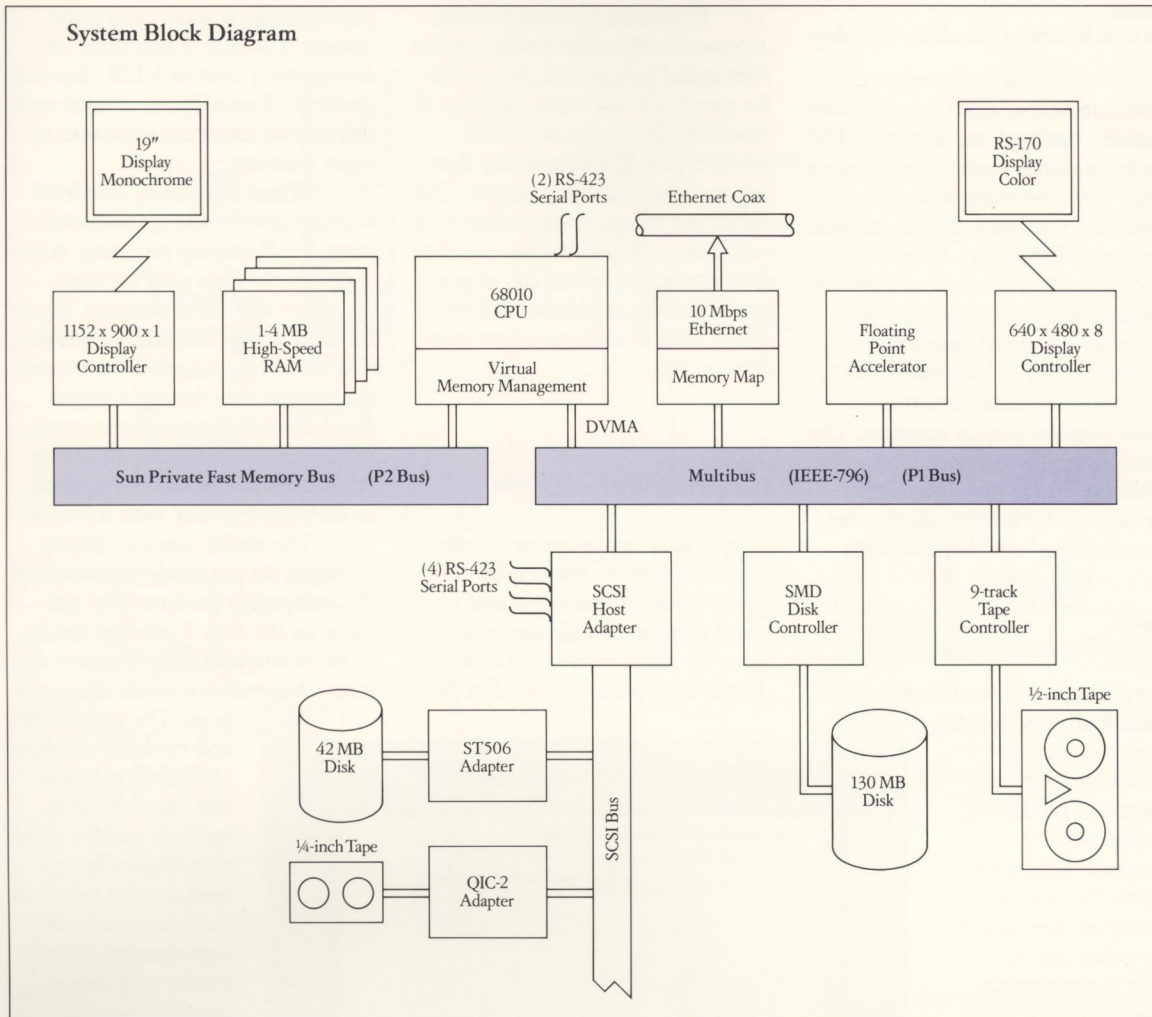

"wait states" (wasted clock cycles) on every access to memory. Some system designs attempt to relieve this problem by introducing expensive high-speed cache memory to speed up memory access. The high-speed Sun-2 memory management unit allows the processor to access all of main memory with no wait states—in effect turning all of main memory into cache.

The memory management unit ("MMU") for the Sun-2 family implements two-level address translation for virtual memory operations, providing both segment and page addressing. The MMU hardware provides a protected system environment for multiprocessing by supporting separate *read, write,* and *execute* permissions for both the operating system and the user on every page of memory. Optimizations for the UNIX operating system include referenced and modified bits for each page of memory (to facilitate efficient demand paging algorithms) and hardware support for eight separate contexts (to facilitate rapid process switching).

System Block Diagram

```
        19"                                                                          RS-170
      Display                    (2) RS-423         Ethernet Coax                    Display
    Monochrome                  Serial Ports                                          Color


  1152 x 900 x 1     1-4 MB        68010         10 Mbps       Floating          640 x 480 x 8
    Display        High-Speed      CPU          Ethernet        Point              Display
   Controller        RAM                                     Accelerator          Controller
                                  Virtual      Memory Map
                             Memory Management

                                        DVMA

  ┌────────────────────────────────────────┐  ┌──────────────────────────────────────────────┐
  │ Sun Private Fast Memory Bus  (P2 Bus)  │  │  Multibus    (IEEE-796)    (P1 Bus)           │
  └────────────────────────────────────────┘  └──────────────────────────────────────────────┘

  (4) RS-423
  Serial Ports        SCSI              SMD              9-track
                      Host              Disk              Tape
                     Adapter         Controller        Controller
                                                                              ½-inch Tape

    42 MB          ST506
     Disk         Adapter
                                   130 MB
                                    Disk
  ¼-inch Tape                SCSI Bus
                   QIC-2
                  Adapter
```

Direct Virtual Memory Access

For greater system performance, the Sun-2 MMU also supports *Direct Virtual Memory Access* ("DVMA™"). High-speed peripheral devices such as disk and tape drives are able to transfer data directly to and from private memory through the MMU on the processor board. The MMU enhances system reliability by allowing DMA devices to operate with virtual memory addresses that are translated and protected, exactly as are program accesses to main memory.

Main Memory

The Sun-2/120 is equipped with 1 megabyte of main memory standard, while the Sun-2/170 is equipped with 2 megabytes. Both may be expanded up to 4 megabytes in 1-megabyte increments. Sun main memory uses high-speed (150 nanosecond) dynamic RAMs to complement the 10 MHz processor and no-wait-state memory management. All system memory is equipped with parity error detection.

CPU On-board Peripherals

Additional features of the Sun-2 processor architecture include a time-of-day clock with battery backup, used by the operating system during the completely automatic system boot procedure; and two RS-423 serial ports with modem control. Compatible with the older RS-232C standard, these serial ports are useful for driving output devices such as printers and plotters.

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Monochrome Graphics Display

The black-and-white monitor (standard on a Sun-2/120 Deskside Sun-Station, optional on a Sun-2/170 Rackmountable SunStation) displays more than one million pixels, organized in 900 rows of 1152 columns. This high-bandwidth 19-inch landscape console provides the large viewing area and high resolution required by advanced user interface software, such as integrated text and graphics editors and the Sun multi-window display manager. The Sun-2 video controller refreshes the screen at 70 Hz non-interlaced, providing a flicker-free display for even the most detailed images.

Monochrome Frame Buffer

From a logical viewpoint, the Sun-2 frame buffer is part of main memory: programs create display images by modifying "frame buffer memory." Programs access this region exactly as they would any other part of their address space, through direct memory manipulations, leading to simpler programming.

Physically, the Sun-2 monochrome frame buffer resides on the high-speed private bus along with the processor and main memory. It provides 128 kilobytes of dual-ported frame buffer memory that drives the actual video output. This eliminates memory contention that would degrade performance, if the display were refreshed out of program memory, and increased expense, if all of main memory were dual-ported.

RasterOp Processor

Placing arbitrary bit patterns at arbitrary locations on the display requires complex manipulations of raster patterns. Hardware assistance for these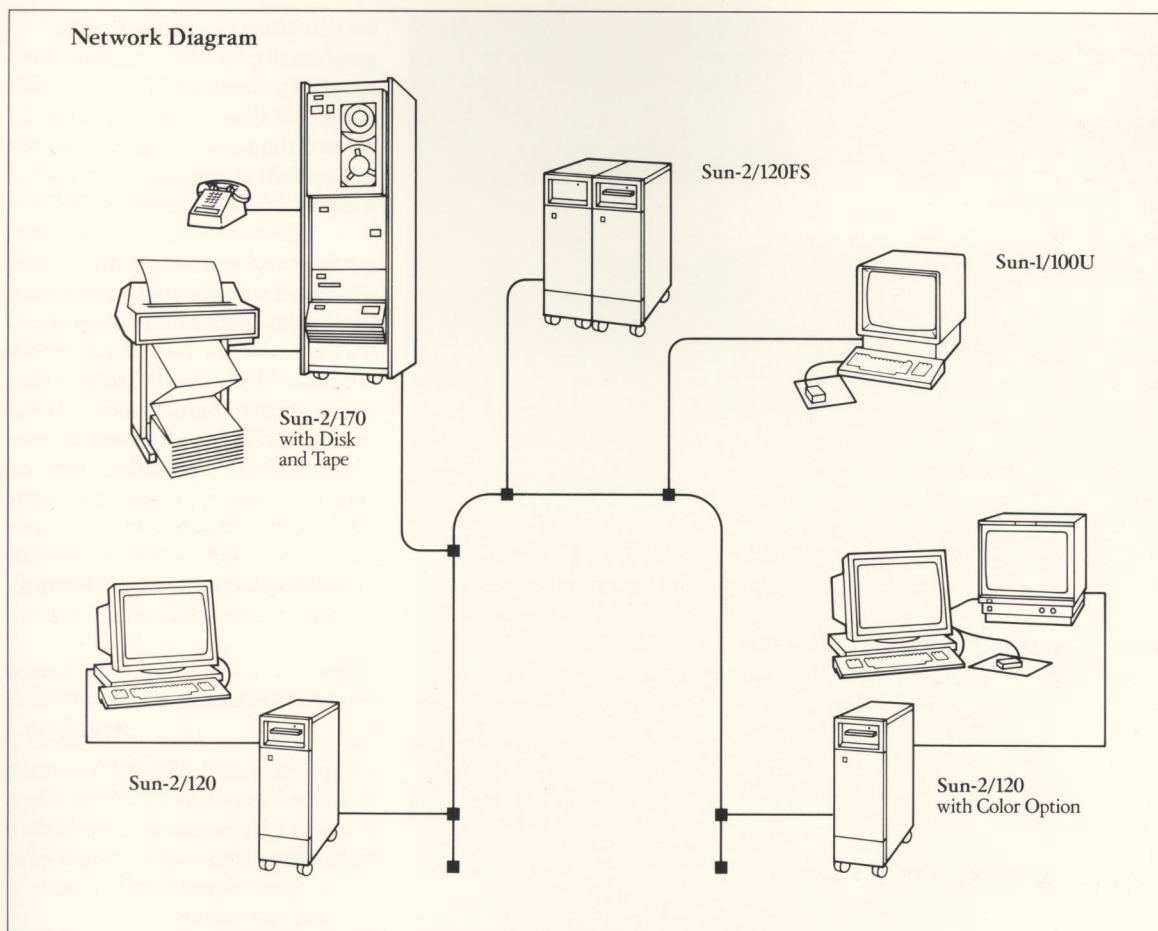 raster operations (RasterOps) helps provide fast display operations and a responsive system. The Sun-2 processor incorporates a custom VLSI chip that performs RasterOps on source and destination locations anywhere in main memory.

When invoked by low-level window system and graphics software, the RasterOp processor is inserted in the data path between processor and main memory. It performs shifting, boolean operations, and masking, using the source and destination data during a single *Read-Modify-Write* memory cycle, replacing numerous MC68010 instructions that would be required to perform this task with software.

The multi-window display manager, an essential component of the computing environment provided by the Sun-2 product family, is one example of an application that makes heavy use of raster manipulations. The user creates and modifies windows as needed, to maintain the context of multiple parallel activities. RasterOps are used to paint windows containing arbitrary alphanumeric text and/or graphics at arbitrary, possibly overlapping locations on the display.

Network Diagram

Sun-2/120FS

Sun-1/100U

Sun-2/170
with Disk
and Tape

Sun-2/120

Sun-2/120
with Color Option

Local Network Support

Local area network communications is a standard capability of every Sun-2 Workstation. The local network hardware and software permit several types of resource sharing among clusters of Sun Workstations, such as common printer service and common modems for remote telecommunications. They also provide traditional distributed system communications functions, such as file transfer and electronic mail between individual network nodes.

Most importantly, the local net enables Sun Workstations to operate without disk storage on every node. Instead, diskless nodes use the network to perform demand paging as well as ordinary file input and output. One node (a Sun-2/120FS or Sun-2/170) can supply mass storage for multiple diskless nodes. This allows the use of larger, more cost-effective peripherals, located away from the users' offices and possibly maintained by a network administrator.

Ethernet Interface

The design of the Ethernet interface for the Sun-2 Workstations is an integral part of the Sun-2 family architecture. Meeting peak performance requirements in a network server configuration, where many clients may be funneling requests to a single server, was a key design criterion.

For that reason, the Sun-2 Ethernet controller is equipped with 256 kilobytes of on-board buffer memory. It accepts back-to-back packets from the Ethernet while simultaneously accepting DMA transfers from disk controllers. After the CPU initiates a disk transfer, the processor can build Ethernet packet headers while the disk transfers data into Ethernet buffer memory. The Ethernet controller, using its own on-board memory management unit, then "gathers" the complete packet as it transmits it, avoiding the overhead of copying data. Less overhead on the server results in better performance for every client.

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*Sun-2/120 FS
with second
130 MB
Winchester
disk pedestal.*

Network Configurations

One high-performance Ethernet interface is standard with each Sun-2/120 and Sun-2/170, whether it will be a client or a server. A second Ethernet interface may be added to a Sun-2/120 or Sun-2/170 in order to build a gateway between physically separate Ethernets in the same local area. When the physical network topology includes these gateways, the gateways are not visible to application programs. All network services (except disk service for diskless workstations) proceed as if there was a single logical network.

Sun-1/100U and Sun-1/150U workstations, if upgraded to run the same software release, may coexist on the same physical Ethernet. Either Sun-1 or Sun-2 nodes may be servers for either Sun-1 or Sun-2 clients.

Dedicated Server Configurations

One possible use of the Sun-2/120 is as a dedicated network server for a small cluster of Sun Workstations. The **Sun-2/120FS** deletes the bitmapped monitor, display controller, keyboard, and optical mouse to provide a cost-effective configuration for this situation. Instead of the graphics display, the customer supplies a standard ASCII terminal for use as the system console. Otherwise, all the standard system features and options are identical for both the Sun-2/120 and Sun-2/120FS.

The Sun-2/170 is most frequently used as a dedicated network server, because the most cost-effective large-capacity disk drives are only available for rack mounting. Also, the 15-slot card cage provides much greater configuration and expansion flexibility, allowing the use of multiple disk controllers, tape controllers, and other peripheral interfaces. For these reasons the standard Sun-2/170 does *not* include the bitmapped display; it is available as an option.

Stand-alone Configuration

For applications where the Sun-2/120 or the Sun-2/170 will be used in a stand-alone environment, the network interface may be deleted from the normal configuration. The system then requires both a local disk and tape option.

Multi-vendor Networks

Sun's choice of the industry-standard 10 megabit-per-second Ethernet for networking Sun Workstations simplifies the task of building multivendor networking environments. On top of the Ethernet low-level protocols, Sun Workstations implement the Address Resolution Protocol (ARP), Internetwork Protocol (IP), and Transmission Control Protocol (TCP) developed by the United States Department of Defense. Implementations of TCP and IP exist for many operating systems on hardware ranging from supercomputer mainframes to personal computers. With compatible higher-level protocols, file transfer and other user-level services are possible between heterogeneous systems.

SunCore Library

To aid programmers in developing or porting graphics applications, Sun software includes the SunCore graphics library, Sun's implementation of the ACM Siggraph Core specification. SunCore provides a library of high-level procedures for creating graphics images, such as commands for drawing vectors, filling solid regions, and moving and scaling image segments. The device-independent SunCore routines, callable from any programming language, insulate programmers from device-specific details such as the number of pixels on a display.

SunCore implements the full Siggraph Core standard: level 3C for output primitives and level 2 for input primitives. SunCore device-independent 2-D, 3-D, and raster graphics primitives support all Sun Workstation displays and also operate within the Sun window system.

Sun has added a number of extensions to SunCore for capabilities not specified in the Siggraph standard, including support for smooth surface shading of polygons (for the Sun color display) and hidden surface removal using a virtual memory z-buffer.

SunWindows

The Sun window system provides complete display management and user interface design facilities for the Sun Workstation. SunWindows allows the user to create many, possibly overlapping, windows containing both text and graphics, in order to visually manage multiple concurrent tasks. Interacting with the optical mouse, the window manager supports pop-up menus for manipulating the window environment: creating new windows; opening and closing windows and icons; and hiding, exposing, moving, and changing the size of existing windows.

Sun has implemented standard "application windows" which provide a virtual terminal interface to UNIX, giving easy access to existing terminal-based applications that are not integrated with the window system. With these virtual terminal windows, users in effect have multiple terminals on their desks. They can use standard utilities such as the screen editor *vi* and electronic mail, while simultaneously compiling new program modules and debugging an application that generates graphic output. Using the mouse, the user can select data from one window and insert it into another, as well as modify the windows themselves.

In addition to these standard windows, SunWindows is "open" to the user who wishes to more completely integrate an application into the window environment. Sun has specified layers of functionality within the window system architecture and provides subroutine libraries implementing a programmatic interface to each layer. Each layer of the window system adds additional capabilities built from the facilities provided by the lower layers, permitting users to customize SunWindows for their needs.

At the lowest level, SunWindows provides two device-independent interfaces: raster output primitives for displays, and a stream input format for keyboards and mice. Above the input-output level, SunWindows provides tools for defining a hierarchical set of windows on the display. If windows overlap, the window manager automatically performs clipping and display locking during screen updates. At higher
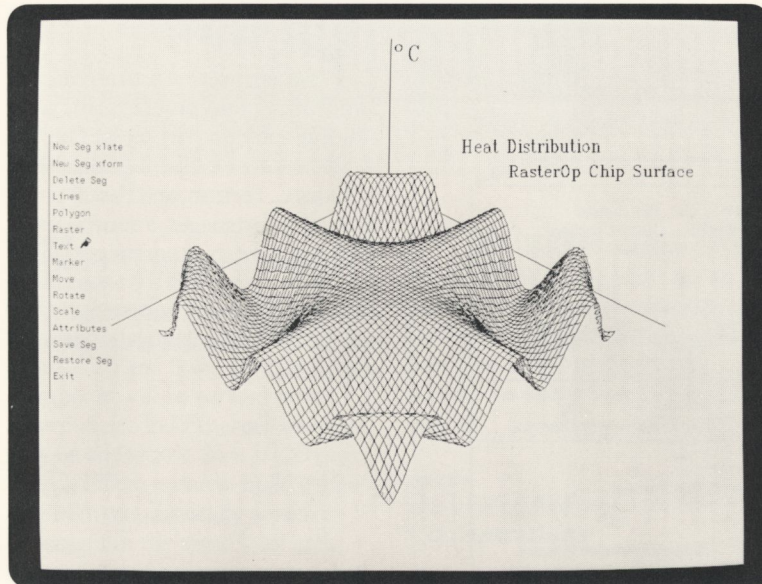
SunCore facilitates the development of device-independent 2D and 3D images.
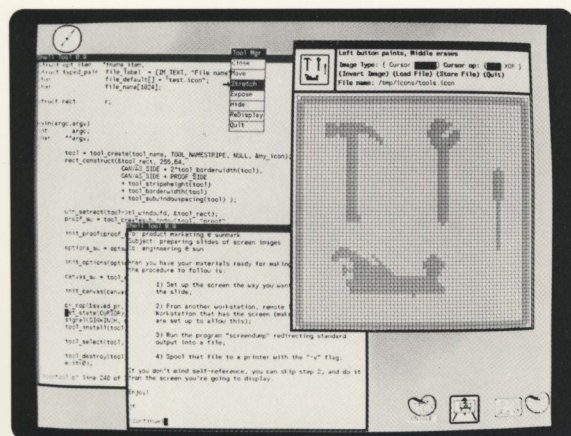

Heat Distribution
RasterOp Chip Surface
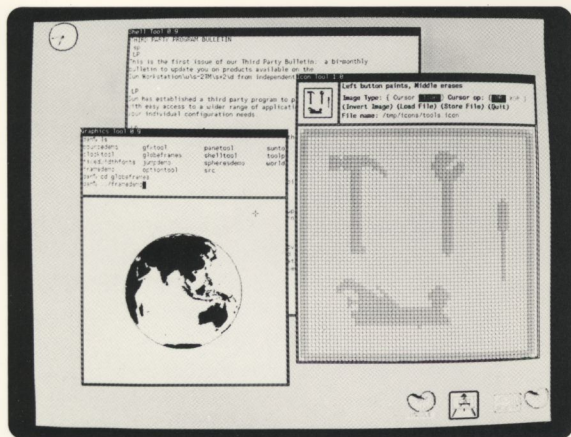
SunWindows supports the creation and manipulation of overlapping windows containing both text and graphics.

The optical mouse and pop-up menus are used to manipulate the icons, windows, and window contents.
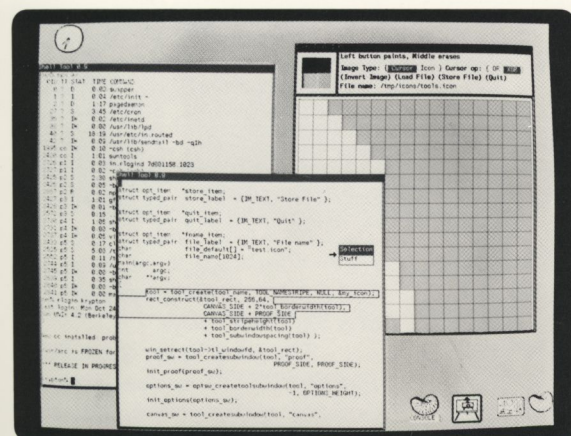
SunWindows provides both standard application windows and a programmatic interface for specifying custom application windows.

levels, SunWindows supports many user-interface facilities, including pop-up, stackable menus to manipulate the window environment, and an *icon* facility, which supplies small symbolic representations of closed windows for easy recall. Users have programmatic access to any or all of these levels in the SunWindows system.

Third-Party Program

Sun Microsystems sponsors an active program to promote the development of new software and the porting of existing software to the Sun Workstation. Many packages are already available from third-party software vendors, and the number is growing rapidly.

Third-party program bulletins are issued regularly and are available at any Sun field office. Products available today include additional "horizontal" (general-purpose) software tools, such as database managers, word processors, and programming languages; "vertical" (specific) application packages, such as printed circuit board layout and page composition for phototypesetting; and support for additional hardware devices, such as high-resolution laser printers.

Optional Hardware and Peripherals

The "open system" hardware and software design philosophy and the selection of a Multibus system backplane for the Sun-2/120 and Sun-2/170 facilitates the integration of a variety of peripherals into these Workstations. Options available from Sun Microsystems provide mass storage, backup, enhanced computational performance, and color display capability.

Hardware Floating Point Option

Floating point arithmetic on Sun Workstations is normally performed by software subroutines, using IEEE-754 standard formats for 32-bit single and 64-bit double precision operations. The hardware floating point option equips a Sun-2 workstation with a floating point processor ("FPP") that supports IEEE standard format. Adding an FPP will substantially reduce the execution time of computationally intensive algorithms.

Floating point support is architecturally designed into the Sun-2 product family so that the user's programs need not be aware of the presence or absence of the hardware FPP. Using the "vector library" compiler switch, *binary* applications are transportable between machines with and without the FPP option. Moving programs requires no recompilation or relinking, a major benefit in networks where not every node has an FPP. For non-networked application environments and where binary portability is not required, the "in-line code" compiler switch provides peak floating point performance.

Mass Storage Options

Both Sun-2 models offer ¼-inch and ½-inch tape options, and disk options in several capacities. All Sun-2/170 disk and tape options are packaged for mounting in a 19-inch rack; Sun-2/120 disk and tape options, except the ½-inch tape drive, are pedestal-mounted for office installation.

The pedestal unit that houses the electronics for the Sun-2/120 provides for the installation of a 42 megabyte (50 MB unformatted), 5¼-inch Winchester disk drive and ¼-inch streaming tape cartridge drive. These options make it possible to configure the Sun-2/120 as a self-contained stand-alone computer system, for applications where networking is not required. They may also be used to add local storage to a Sun-2/120 that is a network node.

Only one interface is required for either or both of these options. Called an *SCSI host adapter,* it supports the new ANSI-standard (ANSC X3T9.2) *Small Computer System Interface* ("SCSI"), which specifies a high-speed parallel bus for multiple intelligent device controllers. The host adapter for the Sun-2/120 also provides four RS-423 serial ports for driving additional output devices (in addition to the two RS-423 ports provided by the Sun-2 processor).

The SCSI interface, with four RS-423 ports, is also used for the ¼-inch tape backup option on the Sun-2/170.

If larger storage capacity is required, the Sun-2/120 is available with a second pedestal unit containing 130 megabytes (168 MB unformatted) of disk space. The second pedestal connects to the Sun-2/120 through a high-performance non-interleaved SMD disk controller instead of the SCSI interface. (If present, the ¼-inch tape unit using the SCSI interface is mounted in the first pedestal.)

High-speed Winchester disk drives in three capacities are available for the Sun-2/170, all connecting through the SMD disk controller: 65 megabytes (84 MB unformatted), 130 megabytes (169 MB unformatted), and 380 megabytes (474 MB unformatted). Each of these disks connects to the system through an SMD disk controller, with either one or two drives per controller.

For environments where traditional ½-inch tapes are desirable, the Sun-2/120 and Sun-2/170 offer a ½-inch, 1600 bpi, 9-track tape drive option. This tape drive requires a separate 19-inch rack for mounting, and connects to either system through a dedicated controller.

Color Display Options

Many workstation applications require color displays in addition to monochrome. Color is often used to assist the user in assimilating complex data, such as VLSI circuitry layers. Some applications are not possible without many additional intensity levels, such as image processing.

The Sun-2/120 and Sun-2/170 offer a medium-resolution color display controller option that displays pixels in 480 rows of 640 columns. Each pixel is stored with 8 bits of color value, resulting in up to 256 colors simultaneously on the screen. However, the display controller uses this 8-bit value as an index into a color lookup table which is separately set up by the application. The lookup table yields 24 bits of color—8 bits each of red, green, and blue—thus providing a palette of over 16 million colors.

The color display controller generates RS-170 standard output (separate red, blue, green, and sync signals) for a 60 Hertz interlaced monitor. The color option is available either as display controller alone, or with a 13-inch or 19-inch landscape color monitor.

The *Standard Support Program* provides:

Software Support
- Coverage for all standard software supplied by Sun: UNIX 4.2, utilities, networking, window management, languages, and SunCore graphics library
- Periodic software releases - incorporating the latest enhancements
- Software problem reporting service
- Periodic software status bulletins

Hardware Support
- All parts and factory labor required to maintain Sun Work-stations and peripherals in normal operating condition
- Expedited factory exchange or repair of defective modules
- Engineering changes to keep Sun products at the current revision level

A software support specialist assists the customer in classifying a question as either hardware or software related. This specialist directly handles the resolution of software questions.

For hardware questions, a hardware support specialist assists the customer in isolating the cause of the problem to the module level. Sun then expedites shipment of a replacement or expedites factory repair of the failed module.

Sun Microsystems offers major system modules as spare parts for those customers who wish to perform their own service or who desire a local repair parts stock. These modules are completely tested and burned-in by Sun to ensure reliable operation.

Fixed-cost module repair service is available from the field service organization at Sun's head-quarters. Schematics and other detailed technical specifications are not part of spare parts documentation.

Sun Service

Sun Microsystems® offers a comprehensive hardware and software support program for all its products.

Sun technical support staff located in each Sun field office or at Sun Microsystems' headquarters in California provide each customer with a single point of contact for both software and hardware support questions.

Specifications

Card Cage/Backplane

Bus Type	Multibus (IEEE-796)
Bus Arbitration	Parallel

Processor

CPU Type	MC68010
Clock Rate	10 MHz, 0 wait states
Firmware	32 KB PROM monitor
Graphics Assist	VLSI RasterOp

Memory Management

Virtual Memory	16 MB per process
Address Translation	2 level (segment and page)
Protection	Page-level R, W, X
Contexts	8 in hardware
I/O Interface	DMA (DVMA)

Main Memory

Maximum RAM	4 megabytes
Error detection	Byte parity

Ethernet Interface

Media Type	Coaxial cable
Data Rate	10 Mbps
Access Control	CSMA/CD Protocol
Buffer Size	256 KB

Monochrome Display

Monitor Format	19-inch landscape
Resolution	1152 x 900 x 1
Refresh Rate	70 Hz, non-interlaced
Bandwidth	100 MHz
Phosphor	P-104

Keyboard

Keypads	10-key (left), 15-key (right)
Function Keys	9 keys (top row)
Signaling	Programmable up/down encoding
Interface	Serial

Standard Software

Operating System	UNIX 4.2bsd
Languages	C, Fortran, Pascal, Assembler
Graphics	SunCore library
User Interface	Window manager

Miscellaneous Peripherals

CPU I/O Ports	(2) RS-423 serial (RS-232C compatible)
I/O Speed	19.2 Kbps output, 9.6 Kbps input, asynchronous
CPU Clock	Time-of-day and date with battery backup
SCSI Bus	Single-host subset
SCSI I/O Ports	(4) RS-423 serial (RS-232C compatible)
I/O Speed	19.2 Kbps output, 9.6 Kbps input, asynchronous

Floating Point Processor Option

Data Format	IEEE-754 standard
Precision	32-bit single, 64-bit double

Color Display Option

Monitor Format	13- or 19-inch landscape
Resolution	640 x 480 x 8
Refresh Rate	60 Hz, interlaced
Interface	511-line RS-170 (Red, Green, Blue, Sync)

Tape Options

|	
Media Type	¼-inch cartridge
Drive Type	8000 bpi, 4-track
Operating Mode	90 ips, streaming
Capacity	20 MB per cartridge
Interface	SCSI to QIC-II
Media Type	½-inch reel
Drive Type	1600 bpi, 9-track
Operating Mode	25 ips, start-stop
Capacity	45 MB per reel
Interface	Pertec

Regulatory

|	
RFI Emissions	FCC Class A, VDE Class A (pending)
Safety Approval	UL approved, CSA Certified (pending)

Facility Planning

Temperature	5° to 40°C (41° to 104°F)
Humidity	5 to 80%, non-condensing
AC Voltage	95-125 or 210-250 VAC
AC Frequency	48 to 62 Hz
Cable Length	15 ft. from pedestal to monitor, keyboard, mouse

|	Sun-2/120		Sun-2/170		
Multibus Card Slots	9 (4 used standard)		15 (5 used standard)		
Power Supply Output	450 watts (card cage only)		750 watts		
Standard Main Memory	1 megabyte		2 megabytes		
Formatted Disk Capacity	**42 MB**	**130 MB**	**65 MB**	**130 MB**	**380 MB**
Winchester Platter Size	5¼"	8"	8"	14"	10½"
Unformatted Capacity	50 MB	168 MB	84 MB	169 MB	474 MB
Controller Interface	SCSI	SMD	SMD	SMD	SMD
Average Seek Time	33 ms.	20 ms.	20 ms.	27 ms.	18 ms.
Average Latency Time	8.3 ms.	8.3 ms.	8.3 ms.	10.1 ms.	7.5 ms.
Average Access Time	41.3 ms.	28.3 ms.	28.3 ms.	37.1 ms.	25.5 ms.
Data Transfer Rate	5 Mbps	10 Mbps	10 Mbps	10 Mbps	10 Mbps

Specifications
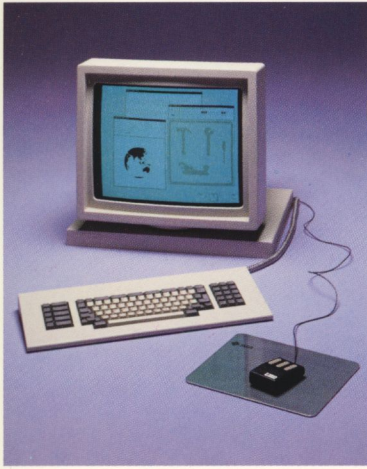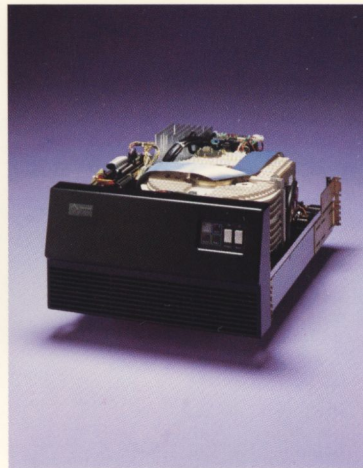
Sun-2/120 Desktop Components
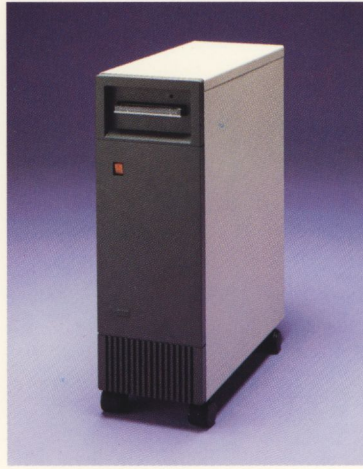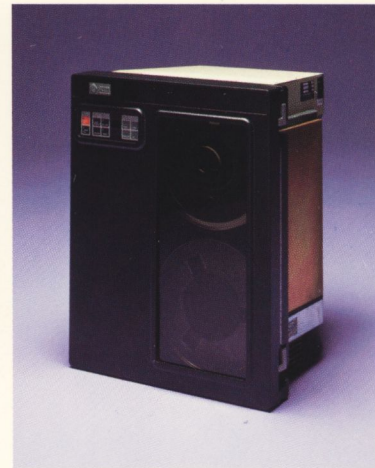

Sun-2/120 Deskside Component
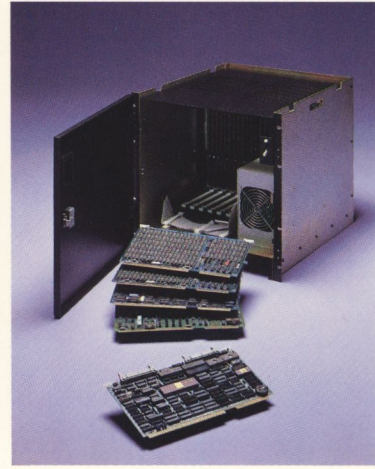
Sun-2/170
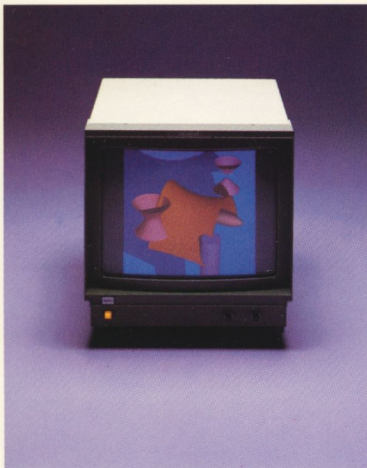
19-inch Color Monitor

380 MB Winchester Disk Drive

1/2-inch Tape Drive

DIMENSIONS and POWER

Component	Height	Width	Depth	Weight	Power	Heat
120 Pedestal	73.7 cm (29.0″)	24.1 cm (9.5″)	54.6 cm (21.5″)	41.8 kg (92 lb.)	750 watts	2560 BTU/hr.
170 Enclosure	45.7 cm (18.0″)	48.3 cm (19.0″)	53.3 cm (21.0″)	27.3 kg (60 lb.)	750 watts	2560 BTU/hr.
Monochrome Display	49.5 cm (19.5″)	53.3 cm (21.0″)	40.6 cm (16.0″)	27.7 kg (61 lb.)	100 watts	340 BTU/hr.
Keyboard	3.8 cm (1.5″)	53.3 cm (21.0″)	21.6 cm (8.5″)	2.3 kg (5 lb.)	N/A	N/A
Mouse Pad	N/A	27.9 cm (11.0″)	22.9 cm (9.0″)	N/A	N/A	N/A
13-inch Color	26.7 cm (10.5″)	40.6 cm (16.0″)	36.8 cm (14.5″)	20.5 kg (45 lb.)	100 watts	340 BTU/hr.
19-inch Color	47.0 cm (18.5″)	45.7 cm (18.0″)	53.3 cm (21.0″)	43.2 kg (95 lb.)	150 watts	515 BTU/hr.
130 MB Disk (Pedestal)	73.7 cm (29.0″)	24.1 cm (9.5″)	54.6 cm (21.5″)	54.5 kg (120 lb.)	340 watts	1160 BTU/hr.
65 MB Disk (Rack)	17.8 cm (7.0″)	49.5 cm (19.5″)	63.5 cm (25.0″)	38.6 kg (85 lb.)	170 watts	580 BTU/hr.
130 MB Disk (Rack)	26.7 cm (10.5″)	48.3 cm (19.0″)	66.0 cm (26.0″)	71.4 kg (157 lb.)	330 watts	1130 BTU/hr.
380 MB Disk (Rack)	26.7 cm (10.5″)	48.3 cm (19.0″)	71.1 cm (28.0″)	62.0 kg (137 lb.)	550 watts	1880 BTU/hr.
½-inch Tape	61.0 cm (24.0″)	48.3 cm (19.0″)	40.6 cm (16.0″)	51.8 kg (114 lb.)	275 watts	940 BTU/hr.
¼-inch Tape	17.8 cm (7.0″)	49.5 cm (19.5″)	63.5 cm (25.0″)	29.5 kg (65 lb.)	170 watts	580 BTU/hr.

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