M/2000 RISComputer

High compute performance balanced by large memory and I/O capacity characterize the powerful M/2000 server.

The promise of RISC (Reduced Instruction Set Computing) technology is to increase performance while maintaining an affordable price. The MIPS™ M/2000 RISComputer™ System delivers that promise. With over 20 mips of CPU speed and matching floating point power, system software, memory and I/O capacity, the M/2000 is the most powerful computer ever produced using RISC technology. It smoothly handles the tasks that, until now, were only practical on the largest supermini and minisupercomputers, and it costs a fraction of their price.

mips

Performance

- 20 mips of processing power from a 25MHz R3000 RISComponent™ CPU
- 3.8 DP Linpack MFLOPS FORTRAN (6.3 SP) for technical computing
- 47,400 Dhrystones/sec and 14,100 DP KWhetstones/sec for balanced speed
- Fast system response for Ethernet® devices and for database management
- 20 megabytes/sec data I/O speed, standard block mode VME bus controllers

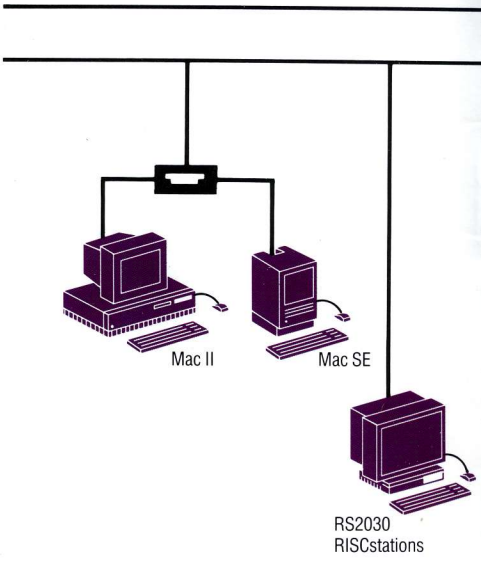
Configurability

- 32MB to 128MB main memory for large programs and multiple users
- Thirteen VME slots for a large complement of high performance controllers
- Support for multiple disk, Ethernet, tape, and serial I/O controllers
- Direct connections for up to 64 serial lines, unlimited indirect serial lines
- Expansion cabinets for additional SMD disk capacity up to 15.7GB
- Optional back-up storage of up to 2GB on helical scan technology 8mm cartridges

Standards

- SVID compliant UNIX® operating System V and BSD converged
- VME bus for standard peripherals, controllers and interfaces
- Advanced optimizing compilers: C, FORTRAN, Pascal, COBOL, Ada,® PL/I
- Ethernet TCP/IP LANs, Network File System (NFS®)
- Binary software compatible with all MIPS RISComputers
- RISCwindows,™ the MIPS tuned implementation of the industry standard X based OSF user interface

Multiple high speed LAN's are supported by the M/2000 in a data center, providing host system services for power users at MIPS RISCstations and a variety of PC's, Macs, UNIX workstations, X stations and character terminals.



The Power of RISC is in the System

The M/2000 RISComputer was designed by MIPS with its second generation RISC technology to maximize performance, using CMOS processors with low cost TTL electronics and high performance I/O techniques. It delivers on these performance and cost objectives. Based on measured mips ratings and the cost of operational multiuser systems in the industry segment having base prices of $75,000 (U.S. list) and up, the M/2000 provides the lowest cost per mip of any computer system.

Software makes the difference in RISC systems. MIPS is the only company offering basic RISC technology that has combined instruction set design and compiler design from the beginning.

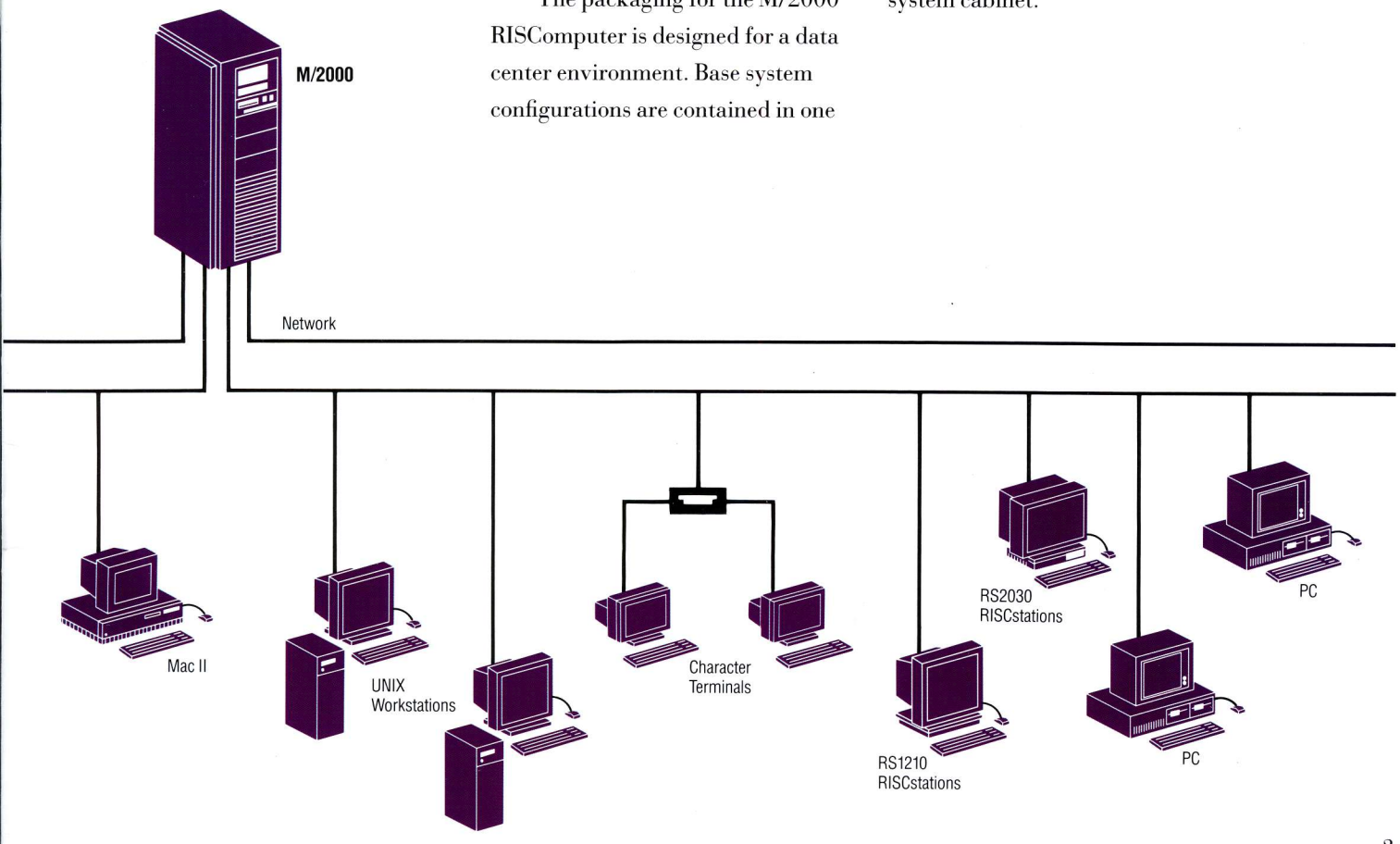
The RISC technology foundation for the M/2000 systems includes robust optimizing compilers that handle large complex programs, and a tuned port of UNIX. These are combined with advanced VLSI semiconductor technology in the CPU and FPU components, and complemented with a host of third party software. In the M/2000, the latest in RISC hardware and software technology combine to provide a functional, affordable, very high performance computer system that delivers the power of RISC.

System Packaging

The packaging for the M/2000 RISComputer is designed for a data center environment. Base system configurations are contained in one cabinet that is 62.5″H x 24″W x 36.5″D (159cmH x 61cmW x 93cmD) and uses 220vac power.

Disk drives and power supplies are located in the lower portion of the system cabinet, the cardcage for the processor and I/O controllers in the middle portion, and the magnetic tape drive in the upper portion. Cabling and I/O connections are accessible at the rear. The cabinet is rack width (19″) internal to accommodate industry standard peripherals and system options.

Where expansion disks and multiple magnetic tape drives are required, one or more expansion cabinets are used. The M/2000 expansion cabinets have the same general size and appearance as the system cabinet.



The M/2000 system packaging design supports the large configurations typically required by high performance 20-mips computer systems. The base system cabinet can contain the CPU, FPU, 128MB of main memory, four 8″ SMD disk spindles, multiple Ethernet LAN ports, multiple serial line ports, multiple parallel printer ports, a 120 MByte ¼″ cartridge tape, a 2 GByte 8mm cartridge tape, and a ½″ magnetic tape drive; all complete with power supplies and cabling. With expansion cabinets, over twenty 8″ disk spindles and multiple mag tapes may be configured. For computer systems that need to start large and then grow even larger over time, the M/2000 has the solutions designed in and ready now.

Compute Power

The advanced computation speed of M/2000 systems is based on the MIPS second generation R3000 RISComponent™ CPU and the companion R3010 Floating Point Unit. These processing units are complemented by large high-speed caches of 64KB each for instructions and data, by sophisticated read/write buffers for minimizing memory access overhead, and by a fast (100MB/sec) memory system that uses new instruction streaming and data block refill techniques.

The resulting computing power places the M/2000 RISComputer above current high-end supermini systems. Processing power is measured at over 20 sustained mips, 47,400 Dhrystones, 14M Whetstones DP, and 3.8 MFLOPS Linpack DP FORTRAN. This balanced compute power is applicable to both integer and floating point intensive jobs, as has been measured by the Livermore Loops and many other benchmark results. The M/2000, along with MIPS optimizing RISCompilers,™ outperforms most minisupercomputers on any but the most vectorizable code. And it does it at a fraction of minisupercomputer cost.

I/O Power

Since the high bandwidth between CPU and memory is provided by a separate private memory bus, the full 32-bit VME bus facility is available for I/O transfers. The M/2000 uses intelligent, Direct Memory Access type block mode VME controllers for disks and Ethernet ports. These I/O operations normally are most critical to system throughput and user responsiveness.

The VME I/O bus in the M/2000 achieves data transfer speeds of 20 MB/sec for block mode controllers. This I/O speed is much greater than other VME-based systems due to the controller sophistication and the faster M/2000 system clock and memory, while maintaining all VME standard specifications. The high I/O bandwidth in the M/2000 RISComputer not only accommodates very fast peripheral devices, but also provides for large configurations that require many controllers to function without I/O saturation becoming a limiting factor on system performance.

Systems Software

The software foundation for the M/2000 RISComputers is MIPS port of the UNIX operating system, RISC/os.™ It includes MIPS C language with optimizing compiler and runtime support, TCP/IP for Ethernet networking, and the Network File System (NFS) for remote file system support. RISC/os also includes comprehensive system and user interface utilities of the fully merged UNIX System V.3 and BSD 4.3 versions of UNIX in order to support the largest set of application programs.

MIPS advanced RISCompilers have been proven over time to be the premier language products on RISC systems, efficiently handling large and complex application and system software problems. The entire suite of MIPS language products is available on M/2000 RISComputer systems.

In addition to C, other RISCompilers include FORTRAN with VMS extensions, Pascal, COBOL, Ada, and PL/I. All of these compilers include multi-level optimizations designed to maximize program execution speed with the M/2000's RISC processor.

For advanced development environments, MIPS System Programmers Package (SPP) is available. All of the software on M/2000 systems operates in a demand-paged virtual memory mode with up to 2 GB virtual address space per process. Very large compute-intensive programs with large data requirements are easily handled by the M/2000.

Software

MIPS RISComputers support a wide breadth and depth of application software in areas such as software development, office automation, computer-aided engineering, database management, and communications.

Software solutions are available through MIPS OEMs, VARs, ISVs and Synthesis Software Solutions, Inc. Synthesis™ is an independent company chartered to acquire, port, distribute and support third-party software for MIPS systems, and systems from many other vendors that use the MIPS RISC architecture. MIPS is an OEM of Synthesis Software Solutions.

Networking

Each M/2000 RISComputer system normally includes one or more Ethernet local area network controllers. With TCP/IP and NFS software included in RISC/os, the M/2000 is equipped to support a wide variety of networking services over Ethernet LAN facilities.

The high speed Ethernet LAN hardware and software permits RISCstations™ and other desktop user devices to be easily connected to and used with M/2000 systems. Included are such diverse products as personal computers, technical workstations, asynchronous character devices via data switches/multiplexers, and office workstations. Using MIPS uShare,™ the M/2000 becomes an excellent server for groups of networked Apple® Macintosh® computers. MIPS uShare is an AppleShare® compatible software package which provides MAC users with email, flexible printspooling, automatic backup of data, terminal emulation and support for larger compute-intensive applications. In conjunction with RISCwindows, the power of the M/2000 makes it also particularly well suited for the support of groups of X Windows-based, bit-mapped Network Display Stations and diskless workstations.

Data Center Systems

With high compute power and massive file capacity, the M/2000 RISComputer has the system performance required for large data centers. It is an ideal host computer on LANs supporting power users in a heterogeneous networked environment. It has the sophisticated systems software to handle the complex, demanding programs and applications normally reserved for million dollar computer systems. It has the standards in hardware and software to protect the users investment, and it has the throughput to keep large numbers of power-hungry users productive.

Expansion cabinets may be added to the M/2000 system cabinet for expanded tape and disk capacity.

Implementation Technology

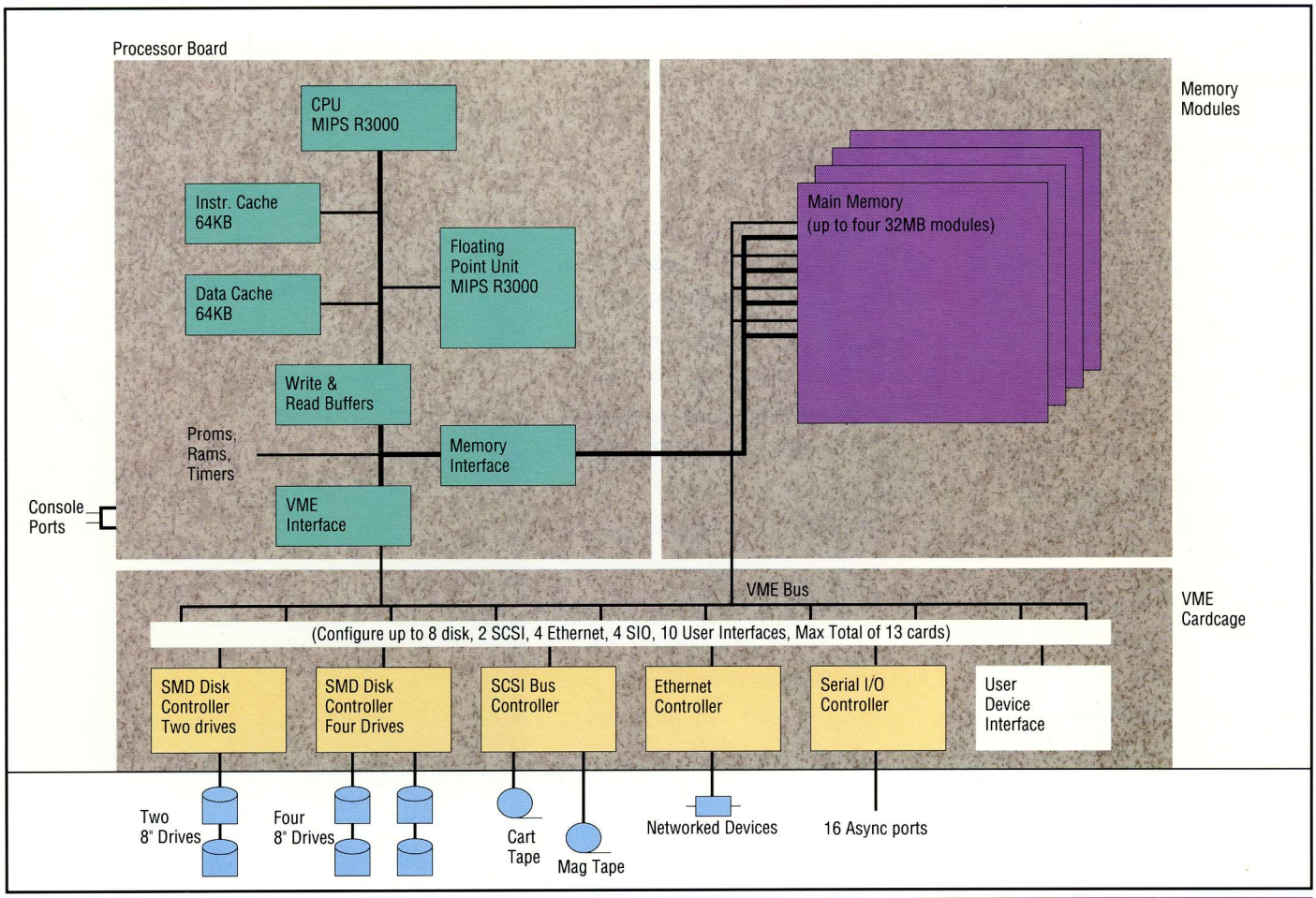
The M/2000's electronics are implemented in CMOS and low cost TTL parts, while other computer systems with comparable or even much lower performance are produced with esoteric ECL and specialty bipolar parts. Use of the latest mainstream electronics technology in an innovative, high performance design is the basis for the cost-effectiveness, compactness, and reliability of the systems. M/2000 RISComputers require only air cooling and use minimum floor space.

Processor Module

The central processor of the M/2000 is contained on one module, 400mm X 366.7mm (16″ X 14.5″) in size. It includes the R3000 RISC processor, the R3010 FPU, 64 KB of high speed cache each for instructions and data, write and read buffers, interfaces to memory and the VME bus, as well as circuitry for boot, test, clocks, and the operator's console ports. The CPU, FPU, caches and write/read buffers are packaged on a 170mm X 190mm (6.7″ X 7.5″) surface mount "daughter board" module in order to minimize circuit line lengths for high speed operation.

The R3000 RISC processor operates almost entirely out of the caches and registers in order to obtain high speed and efficiency. With 32 general purpose registers at a full 32 bits wordlength each, five levels of pipelining, 64KB of

Functional Block Diagram for the M/2000 RISComputer.



instruction cache, 64KB of data cache, and 4-deep write buffers, the design is equipped for fast operations. Only simple load/store operations are used for memory access to instructions and data. The MIPS RISCompilers take advantage of this complex performance-oriented RISC structure, and effectively organize the flow of instructions and the location of data for best overall results.

For the 25 MHz R3000 processor, the CMOS SRAM caches collectively provide an aggregate maximum instruction/data bandwidth of 200MB/sec. For memory reads, the caches are direct-mapped. With large caches such as the M/2000 has, this technique is the most efficient as it avoids replacement decisions and algorithm calculations. Data and address writes to memory are buffered up to four words deep so that memory write operations can be performed during RUN cycles, avoiding most write time delays.

The R3010 Floating Point Unit is tightly coupled to the R3000, and seamlessly extends the CPU's instruction set for floating point operations. The pipelined FPU executes instructions in parallel with the pipelined CPU. Any of the three classes of FPU operations (add/subtract/convert format, multiply, and divide) can be performed concurrently with each other and also concurrently with CPU operations. The R3010 FPU contains sixteen 64-bit registers that each can hold data for single or double precision calculations. FPU operations, including the coordination of the FPU with the CPU, are managed by MIPS RISCompilers for optimum overall execution efficiency.

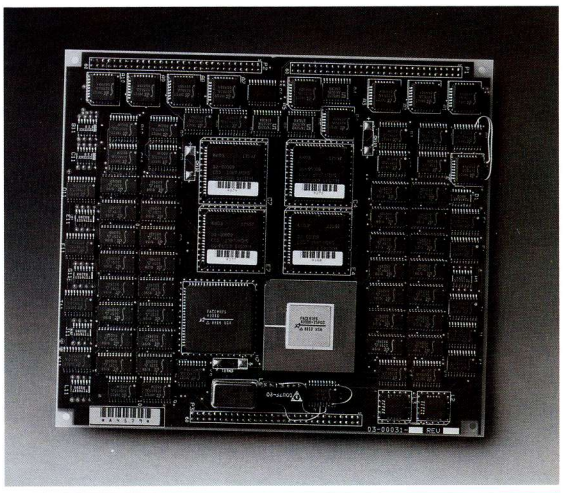
Buses to memory and to VME for I/O are separate. Each is 32 bits wide for data and 32 bits wide for addresses. Interfaces to these buses are on the CPU module. Also included are "boot" instructions and power-on diagnostics in non-volatile memory, local and system clocks and timers, and the console interface.

Main Memory

With the CPU operating out of large caches, the task of memory is to keep the caches supplied with program instructions and data as they are needed. While access to main memory is infrequently required, the memory system must nevertheless respond rapidly when cache misses do occur in order to minimize their impact on performance. The M/2000 RISComputer's memory system uses high transfer speed along with advanced instruction streaming and data block refill techniques to accomplish this.

The M/2000 memory bus is synchronous and supports 32-bit word transfers to/from the CPU and caches at the rate of 100MB/sec. Note that the operation of a 32-bit wordlength CPU at a 25MHz instruction execution rate means that one 4-byte instruction word is required every 40 nanoseconds, or 100MB/second. (Instructions are supplied out of the instruction cache at the CPU's rated speed unless and until a cache miss occurs.)

Upon a cache miss in the M/2000 instruction cache, the transfer of a group of 16 consecutive words is initiated from memory. As soon as the instruction "miss" is supplied, processing immediately resumes with the execution of the instruction concurrently as it is loaded into the cache. Also, sequential instructions in the same 16-word segment are supplied from memory at full memory-bus speed.



The heart of the M/2000 RISComputer is a surface-mount module that contains the CPU, FPU, caches, and write buffers.

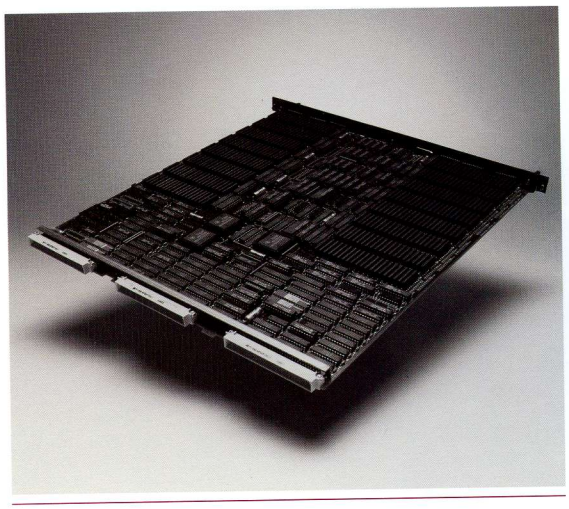
The instruction flow (as organized by the RISCompilers) makes it highly likely that the instructions following the "miss" will be executed in succession. When they are needed, they are available without another "miss" in the instruction cache and without delay. This is *instruction streaming*, an advanced CPU and memory design technique for maximizing instruction execution efficiency in a RISC design with a large instruction cache and with compilers matched to the architecture.

Instruction streaming in RISC designs is exclusive to MIPS R3000-based systems. Patent applications have been submitted.

Data block refill is similar to instruction streaming except that it operates on data rather than on instructions. When a cache miss occurs in the M/2000 data cache, the transfer of a block of 16 consecutive words is initiated from memory. The "missed" data word is obtained from the block as it is transferred, and processing resumes immediately upon completion of the block transfer. Other words in the block are supplied to the data cache from memory at full memory-bus speed. Data locality makes it likely that data in adjacent words will soon be required. With data block refill, data words adjacent to the miss are available from the data cache without any delay when they are required.

Without instruction streaming and data block refill, simulations show that the M/2000 would have a cache hit rate of about 90%. With these techniques, the actual cache hit rate experienced, running real programs, is about 99%. This improvement contributes significantly to the speed of the machine. The M/2000 executes an instruction, on average, every 1.25 machine cycles—the highest efficiency yet for a RISC design.

The size of the M/2000 memory modules is 32MB, and each is implemented using 1Mbit DRAMS. Memory components are arranged in two separate arrays per module, with interleaving used to obtain 40ns bus speed using commercial grade 100ns memory parts. Error checking and correction (ECC) is contained on each memory module, using seven ECC bits per 32-bit word with a Hamming code such that all single bit errors are corrected and all double bit errors are detected. Memory is dual ported for separate access by the memory bus and by high speed direct memory access (DMA) I/O devices on the VME bus. Up to four ECC memory modules may be configured for a maximum system memory size of 128MB.



The memory system of the M/2000 is comprised of up to four modules that provide memory access at 100MB/sec for the CPU and 20MB/sec for block mode I/O.

VME Cardcage

In the M/2000 rack-width system cabinet, an 18-slot triple-high VME card cage is used to contain the processor, memory, and I/O controllers. All modules in the cardcage are accessed from the front of the cabinet. The five left-most cardcage slots are reserved for the CPU and memory boards, leaving 13 slots for I/O. Spacing of the cardcage slots is 20.6mm (13/16″) apart on centers.

All cardcage slots accept 21U Eurocard standard (triple-high, seven units deep) VME cards, 400 X 366.7 mm in size. Adapter cards are used to fill out the unused area for smaller VME cards, so that the typical 6U size (double-high X 3

deep) VME controller cards are accommodated while uniform front access to all cards is maintained.

Cabling from the front of the cards, when present, is routed up to clips for each card slot so that every card is removable for service without disturbing other cards; and is then routed down the side of the cardcage to the rear of the system cabinet for connection to peripheral devices. The 220vac power supply for the cardcage supports a full complement of 4 memory and 13 I/O cards.

Block mode VME Controllers

The M/2000 RISComputer I/O system supports the fast "block mode" controllers as defined in the VME specification. These controllers contain local intelligence and have local buffers for I/O data. They support data transfers to and from memory in blocks of up to 256 bytes in size. The M/2000 memory system takes advantage of VME block transfers and page mode memory cycles to minimize the memory bandwidth used by I/O controllers. During a DMA block mode transfer, the data moves at 20MB/second so that efficient high speed I/O is achieved.

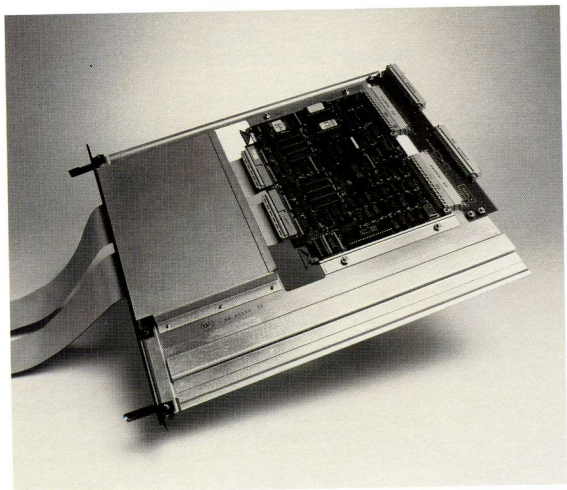
For peripherals which normally access memory in multi-word data segments—such as disks, Ethernet LANs, tapes, and other similar high speed devices—the use of block mode DMA controller operation significantly improves I/O speed. It handles I/O operations in minimum time and with minimum system overhead. This is especially beneficial for disk I/O and for support of X-stations and workstations over Ethernet using RISCwindows or NFS. It also enables large numbers of controllers to share the VME bus without overloading it. The result is increased overall system responsiveness and throughput.

Magnetic Peripherals

The M/2000 RISComputer supports the standard SMD disk controllers for interfacing to 8″ Winchester disk drives. Fast block mode VME controllers supporting either two drives or four drives are available.

The bottom section of the M/2000 system cabinet has space for up to two disk trays. Each tray holds up to two 8″ disk drives and the associated power supply, and uses 5.25″ of vertical rack space. The trays are on slides, and can be pulled out for access to the disks. (An anti-tip extension in the front base of the cabinet may be pulled out for safety.) For expansion beyond two disk trays, expansion cabinets are available. Maximum M/2000 disk capacity using 8″ drives is 24 spindles, or 15.7 gigabytes formatted.

The system cabinet includes a 120MB cartridge tape and an optional 8mm back-up cartridge drive, both with front access for support and service use. The QIC-120 standard ¼″ cartridge tape drive reads and writes 120MB cartridges for back-up and data interchange, and also reads 60MB cartridges for convenience in software distribution. With a capacity of up to 2 GBytes of data, the helical scan 8mm tape drive is ideal for back-up of large disk files. A ½″ streaming magnetic tape drive, operable at 6250/1600 bpi, normally occupies the top space in the M/2000 system cabinet.



The full size VME cardcage can accept large, triple-high cards, and smaller, double-high cards using adapter boards.

Space Usage in the Cabinets

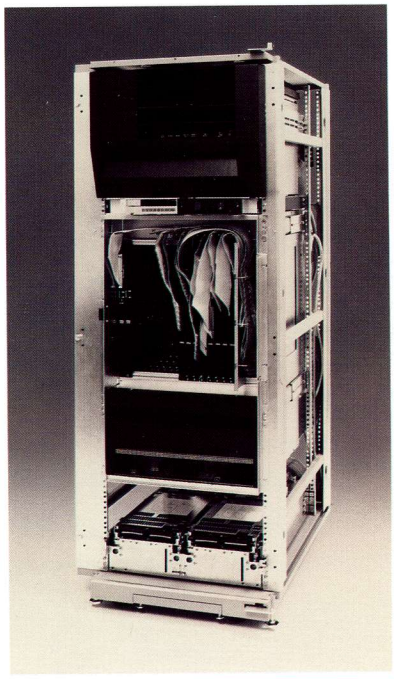
The 19″ rack-width M/2000 system cabinet provides 55.5″ (141cm) of usable vertical space. From bottom to top, it is used as follows: 10.5″ for two disk trays, 10.5″ for cardcage power supply and cooling fans, 18.75″ for VME cardcage, 1.75″ for ¼ inch and 8mm cartridge tape units and system ON/OFF operator controls, 14″ for mag tape drive.

Expansion cabinets have the same vertical space available as system cabinets. Expansion cabinets may contain a maximum of five 8″ disk trays, or a mag tape drive and four 8″ disk trays. Physical weight and AC power are the limiting factors in configuring expansion cabinets rather than vertical rack space.

The expansion cabinets in an M/2000 configuration are always placed at the right side of the system cabinet (viewed from the front) and are joined with it to minimize interconnecting cable lengths.

Industry Standards in Hardware

The M/2000 RISComputer design incorporates a number of standards in order to minimize cost and protect user investment. Use of standards provides configurability and expandability, utilizing products and technology from a variety of suppliers. The major hardware standards supported are VME/SMD and Small Computer Systems Interface (SCSI, ANSI X3T9.2) for magnetic storage peripherals, Ethernet IEEE 802.3 for LAN connection to user devices, the standard Eurocard/VME bus for interfacing to I/O devices, RS232C with DB25S connectors for serial I/O, and IEE 754-1985 for floating point format. MIPS is committed to the use of standards whenever possible in hardware and software.



The M/2000 system cabinet contains the processor, memory and I/O controller in a VME cardcage. Magnetic peripherals are at the top and bottom. External cabling connections are in the back.

Software Compatibility

The M/2000 RISComputer systems are software compatible with other RISComputer systems from MIPS Computer Systems, and with many systems from other suppliers that are based on the MIPS RISC architecture. MIPS believes compatibility is important to protect customers' software investment and to encourage the addition of new software packages to the MIPS environment.

M/2000 Models

There are two versions of the M/2000 RISComputer; the M/2000-8, and a lower cost, 16 mips version designated as the M/2000-6. Both versions share the same packaging, configurations, peripherals, and run the same software.

M/2000 Specifications

Performance	M/2000-8	M/2000-6
Mips rating*	20	16
Clock frequency	25MHz	20MHz
Cycle time	40 ns	50 ns
Dhrystones/sec	47,400	38,000
KWhetstones, SP	17,300/sec	13,800/sec
KWhetstones, DP	18,200/sec	14,500/sec
Linpack, SP FTN	6.3 Mflops	5.0Mflops
Linpack, DP FTN	3.8 Mflops	3.0Mflops
Linpack, SP coded	7.0 Mflops	5.6Mflops
Linpack, DP coded	4.0 Mflops	3.2Mflops
Floating Point:		
Add time, SP	80 ns	100 ns
Add time, DP	80 ns	100 ns
Mul time, SP	160 ns	200 ns
Mul time, DP	200 ns	250 ns
Div time, SP	440 ns	550 ns
Div time, DP	760 ns	950 ns

Processor Data	
Architecture	MIPS RISC
CPU Type	MIPS R3000
Chip technology	Custom CMOS VLSI
Word length	32 bits
GP registers	32
Pipeline levels	5
Instruction cache	64KB, direct-mapped
Data cache	64KB, direct-mapped
Write buffers	32 bits, 4 stages
Min main memory	32MB
Max main memory	128MB
Error handling	ECC, 7 bits/word
Memory config	32MB/slot, 4 slots
Virtual Adr space	4GB, 2GB/proc.
MMU, software	Demand paging
MMU page size	4 KB
On-chip TLB	64-entry, fully assoc.
CPU/caches bus	200MB/sec
Caches/mem bus	100MB/sec
DMA transfer rate	20 MB/sec blk mode
Interrupt levels	6
Boot EPROM size	256K bytes

Floating Point Data	
FPU Type	MIPS R3010
FP registers	16
Word length	64 bits (double prec.)
Pipeline levels	6
Chip technology	Custom CMOS VLSI

I/O Bus	VME
DMA transfer rate	20MB/sec blk mode
Cardcage I/O slots	13 @ 3-high, 7-deep

Ethernet/VME	up to 4 ports
Protocol type	IEEE 802.3 std
Media type	Coaxial cable
Access control	CSMA/CD protocol
Data rate	10Mbits/sec. each
Console port in base system	RS-232C, DB-25S 2 ports (1 w/modem ctrl)

Serial I/O Direct Connection	
using VME bus	16 lines/slot
VME bus slots	up to 4 for SIO
Max baud rate	19,200/async line
Connectors	RS-232C, DB-25S
Modem Control	standard
Parallel port	1 per SIO card, 2 max
Type	Centronics compat.

Disk I/O	
Disk drive type	8″ Winchester
Controller	SMD, block mode
Transfer rate	3.0 MB/sec max
Drive Capacities	655 MB formatted (825MB unformatted)
or	(270 MB formatted) (337MB unformatted)
Avg seek time	16.5ms
Average Latency	8.3ms
Avg access time	24.8ms
Power consumed	150 watts/drive
Disk Drive MTBF	40,000 hours
Configurations	4 in base cabinet, up to 10 in Exp Cab
Weight per drive	17.7 kg (39 lbs)
Weight per tray	59.5 kg (120 lbs)

SCSI Bus	ANSI X3.131-1986
Max transfer rate	4.0MB/sec sync
Target devices	up to 7

Mag Tape Drive	½″, streaming
Controller	SCSI/VME
Density	6250/1600 bpi
Tape speed	50/100 ips
Tape capacity	180MB, 2400ft reel
Tape drive MTBF	4800hrs @ 25% duty
Power consumed	350 watts max
Configuration	1 in base cabinet, 1 in exp. cabinet

Cartridge Tape Drive	5.25′ half height
Controller	SCSI/VME
¼″ tape capacity optional-	120MB (QIC-120) 60MB (QIC-24)
Operating speed	90ips, streaming
Power consumed	25 watts in use
Tape drive MTBF	12000 hrs @ 25%
Configuration	1 in base cabinet

Back-up Storage	8mm Cartridge
Technology	Helical Scan
Capacity	up to 2 GByte
Controller	SCSI/VME
Transfer Rate	246 KBytes/sec
Non-recov. error rate:	<1 in 10^{13} bits
Drive MTBF	20,000 hrs
Configuration	1 in base cabinet

(continued on reverse)

M/2000 Specifications

(continued)

Dimensions, Weights and Power

	Base System	Expansion Cabinet
Height	159cm (62.5″)	159cm (62.5″)
Width	61cm (24.0″)	61cm (24.0″)
Depth	93cm (36.5″)	93cm (36.5″)
Weight, typical	365kg (800lbs)	250lbs empty
Weight, max	430kg (950lbs)	950lbs full
Shipping weight	450kg (1000lbs)	
AC circuit rating	5500 volt amps	5400 v.a. typ.
Heat in BTUs/hr	20,800 (5500 watts)	

Regulatory

RFI Emissions	FCC Class A VDE Class A
Safety	UL, CSA, TUV, VDE, IEC

Facility Planning

Ambient Temp, op	5°C to 35°C
Relative Humidity	10% to 80% non-c
Altitude	to 3000m (10,000ft)
AC Voltage	180 to 265 vac
AC Frequency	47 to 63 Hz
AC pwr cord lgth	2m (6 ft)

*Based on a suite of 12 benchmarks with the reference for execution time being a VAX 11/780 running VMS software as released in 1987 rated at 1.0 mips. See "Mips Performance Brief" for additional information.

Specifications subject to change without notice.

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